The

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See *The Fish and Wildlife Service*, page 181

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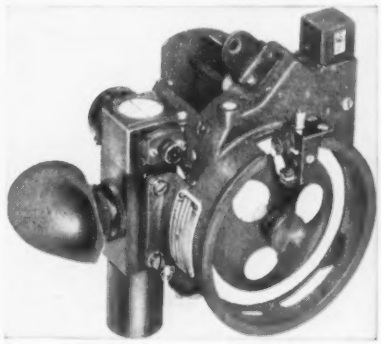

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THE SCIENTIFIC MONTHLY

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THE FISH AND WILDLIFE SERVICE*

A SUMMARY OF RECENT WORK

By IRA N. GABRIELSON

Dr. Gabrielson (Sc.D., Oregon State) was the first Director of the U. S. Fish and Wildlife Service, formed in 1940 by combining the Biological Survey and the Bureau of Fisheries. In 1946 he retired from government service and became President of the Wildlife Management Institute, Washington, D. C. Since the time he entered the Biological Survey in 1915 he has been actively interested in the preservation of wildlife; the knowledge and experience he has thus derived from actual observation have made him an authority in this field.

WHEN *The Scientific Monthly* asked me to write an article on the principal accomplishments of the Fish and Wildlife Service during the period I was Director, first of the Biological Survey, and then of the present organization, I felt it would be an easy task. The attempt to evaluate the relative importance of various undertakings from a perspective somewhat removed from the immediate action has been revealing. As inevitably happens, many events that once seemed important have faded into relative insignificance. Each of these events may have been important at the time, and the very fact that a local victory had been won may have helped the general conservation program. In looking back, however, it seems that much of the significant progress made during the period 1935–46 lies in the intangible field of conservation.

In attempting to evaluate this progress I am entirely conscious of the fact that any results obtained were largely due to a fine staff, the numerous able and talented men who are completely devoted to doing a good job in the management of wildlife resources. Many of them have trained for this field of work and expect to devote their lives to it. Those who enter government service in this specialized field soon realize that the monetary compensation for their work will be relatively modest and that part of the compensation must come from the satisfaction of a job well done. There are many such persons in the Service; without their loyal and enthusiastic support little could have been accomplished. I am also aware that many conservation leaders throughout the land contributed much to the success of our efforts.

Shortly after "Ding" Darling resigned and left a considerably perplexed new Chief of the Biological Survey on the job, the first North American Wildlife Conference met in Washington. At that time I was

* All photographs courtesy of Fish and Wildlife Service, U. S. Department of the Interior, Washington, D. C.

asked to prepare a talk entitled "A National Wildlife Restoration Program." The talk given was the result of the combined thinking of the personnel of the Biological Survey. It outlined in seven points a National Program. There seems no better way to analyze the accomplishments of the Service during the past ten years than to review them against the background of this program:

The first need of wildlife is land; it is a basic essential. Birds cannot nest on the wing, nor can animals reproduce on the run. They must have places to live, to find food, shelter from the elements, and cover for escape from their natural enemies. The completion of a program of restoring 7,500,000 acres of marshland for waterfowl, outlined by Darling, was advocated. Federal primary refuges for major wildlife species were also recommended.

The second need outlined was close cooperation between the Federal and state governments. This involved, first, cooperative research, demonstration, and educational programs between states and the Federal government. The existing ten cooperative research units were a part of that program. The provision of a wildlife extension mechanism for getting information into the hands of people on the land was also advocated. Second, the adoption by the Federal government of a program to help finance state wildlife restoration programs was advised.

The third major proposal suggested a closer coordination of Federal activities, to make the government's conservation work more effective. It was pointed out that little difficulty was experienced in securing cooperation between the principal conservation organizations but that there was great lack of correlation in the Federal government in determining over-all effects of impoundment or drainage operations, mosquito control, dam-building, and other activities of Federal agencies.

The fourth point urged the recognition of wildlife by land-management agencies both public and private. It was emphasized that the future of wildlife in the country was tied absolutely to the land and that the land managers will, in the final analysis, determine the fate of wildlife.

The fifth point stressed the importance of control of pollution. It was pointed out that pollution does vitally affect birds and mammals as well as fish and other forms. It threatens the very existence of aquatic vegetation, the small aquatic insects, the mollusks, and the crustaceans on which our waterfowl, game fish, and water-loving mammals depend. The prevention of new pollution and correction of existing pollution are, therefore, of vital importance.

The sixth point underlined the importance of adequate wildlife research programs. While there is much information on which a better wildlife administration can be based, there is still much to be learned. Also stressed was the fact that constantly changing conditions will require new information and new techniques to meet new problems.

The seventh point emphasized the fact that no wildlife program can be complete without provisions for the protection of the living forms involved. Protective regulations will always be necessary to preserve breeding stocks. Regulations to accomplish this should be based on the condition of wildlife populations rather than on the wishes or desires of the hunting public or on political pressure. It is impossible to manage wildlife intelligently by the slow processes of legislation, and the best mechanism yet developed has been to give to conservation administrative agencies the responsibility for making necessary regulatory changes.

After ten years' effort to accomplish the major objectives, this still seems a good program. If the program were to be written now, doubtless more emphasis would be placed on the educational end. Not that other factors should be emphasized less, but as the years have passed it has become increasingly apparent that an educational mechanism, designed to get sound information into the hands of the men who are living and working on the land in a form they can understand and use is a vital part of the program.

On the same program on which the National Wildlife Program was presented, Frank T. Bell, Chief, U. S. Bureau of Fisheries, presented a similar plan for fisheries.

The future conservation program of the Bureau of Fisheries, [he said, in brief] requiring as it does the full coordination of Federal activities on the one hand, and liberal cooperation on the part of State governments and private organizations on the other, may be divided into two major categories. One is concerned with the conservation of food and game fishes of interior waters now largely used for sport and recreation by millions of our citizens, which I shall discuss under three headings: First, the protection of existing supplies; second, the develop-

ment or expansion of those resources; third, the reclamation of fishing waters. The other category deals with the economic management of the commercial fish supply, including the stabilization of yield, rational exploitation of the supply, and wise use of fishery products.

This was undoubtedly the product of the joint effort of the fisheries staff. Certainly it expresses the philosophy of many still with the Service. In discussing the conservation of food and game fishes of interior waters, the statement outlined the need for preservative regulations designed to coordinate the supply with the harvest. It pointed out the often disastrous effects of the development of water-power and other dams on rivers; the effect of industrialization and the accompanying industrial wastes dumped into the streams; the effect of irrigation on the salmon and steelhead, in the West; and various other factors, which in addition to the direct human harvest are interfering with the maximum possible production of fish in inland waters. A program of artificial restocking to the extent necessary was advocated, and the need for the rehabilitation of the waters destroyed by pollution was pointed out. Also mentioned were the growing difficulties caused by silt, which was affecting more and more rivers as soil erosion became more widespread.

In discussing the commercial fisheries the statement recommended more and better scientific work. It declared:

> With few exceptions, in particular fisheries, one of the simplest principles of animal husbandry may be applied to the commercial fish stock, namely, that the individuals of any species should be marketed at the time when they are of the greatest economic value to the industry and to the consumer, and that they should be protected at the time when they are of the greatest biological value to the species as brood stock. Specifically, this means that fish should not be taken until after they have passed the stage of most rapid growth and until they have spawned a sufficient number of times to assure continued productivity. Thus, in general, small and immature fishes should remain in the water to complete their growth and deposit their eggs. After maturity has supervened and the growth rate has fallen, they may, in general, be marketed with the greatest profit.

This statement of the basic philosophy of the Bureau of Fisheries provides a background for judgment of the operation of the Fish and Wildlife Service after the two bureaus were consolidated in 1940. It is a human failing to look back wistfully at what might have been, but every conservationist must regret that the war put a sudden stop to what was probably the soundest conservation program the nation has yet undertaken.

For example, the ten Cooperative Wildlife Research Units, maintained by the American Wildlife Institute, the Fish and Wildlife Service, and the game departments and agricultural colleges of the ten cooperating states, were only well started when the war stopped many of their activities. The same thing might very well be said of the Pittman-Robertson Act, as the Federal-Aid-to-the-States program is commonly called. This program was just well organized and ready to go at the time war broke out. Almost immediately restrictions on materials and the draft of trained manpower quickly slowed down all projects that were not stopped entirely. In neither case did these two undertakings show the results that could rightfully have been expected from them under normal conditions. Likewise, the research programs in both wildlife and fisheries fields were abruptly halted, often on the very edge of fruitful production, by the diversion of the manpower into the armed forces or other war services. No one can ever compute the total loss, but the losses in new information and in developing additional trained men alone were staggering. Little or no progress was made in the over-all long-range program of conservation during the war years. In fact, most conservation organizations felt

themselves lucky if they did not lose too many of the precious gains that had been made under more favorable conditions. It is too soon to say how long it will be before the work can be resumed and gain the momentum that it had acquired over the years preceding December 7, 1941.

The single most important gain, it seems to me, in conservation of natural resources has been the greater public understanding and support of sound basic principles. As a result of constant discussion and study there is a clearer understanding in the minds of technicians, as well as in those of a growing portion of the general public, of the fact that soil and water conservation and wildlife management cannot be separated. They are different phases of the one big job of managing our lands and waters to preserve their productivity indefinitely and to secure the greatest possible annual return. It makes little difference whether it is in terms of tree or crop growth, wildlife or grasslands, fisheries or fur, if the crop taken is so great as to destroy or deplete the resource or to deplete the soil and water producing them, it is exploitation, not management. For every person who understood this fact ten years ago, there are thousands who now understand it at least dimly. Though millions more should be informed, the progress is gratifying, and the volume of public support for sane and sound programs is much greater than it was in 1935.

In the wildlife field significant progress has been shown by development of the Federal-Aid-to-the-States wildlife program under the Pittman-Robertson Act; the building of the National Wildlife Refuge system; the development by research of better management methods; the development of a cooperative working relationship with the Army Engineers and the Reclamation Service, so that for the first time the Fish and Wildlife Service and biologists had a chance to sit in on the planning of impoundments; the consummation of the Migratory Bird Treaty with Mexico, including numerous species that were not covered by the previous convention with Canada; and the establishment of the Patuxent Wildlife Research Refuge.

In the fisheries field considerable progress has been indicated by the development of the Little Port Walter Salmon Research Station in southeastern Alaska; by development of new techniques in fisheries research; by the vast job of salvaging the salmon runs that formerly spawned above Grand Coulee Dam in the Columbia; by the demonstration that sane management can restore even a depleted oceanic fishery, given by the International Fisheries Commission in handling the Pacific halibut fishery; and by the development of biological standards of water purity. Finally, the increase in accomplishments reflected in public interest and support may be measured by the comparative appropriations available for wildlife and fisheries work for the fiscal year 1936 and those for 1947. Including duck-stamp funds, approximately $4,500,000 of regular funds were available in 1936, as compared with more than $12,000,000 in 1947. Many of the increases have gone into increased pay rates provided by Congressional action, but the totals do indicate real public recognition. Most of the accomplishments came prior to 1941, but despite the loss of construction funds during the war years, Congress has been disposed to support this work.

WILDLIFE PROGRAM

Land for wildlife. On July 1, 1935, there were 6,100,020 acres in established wildlife refuges administered by the Biological Survey; about two-thirds of the acreage was in Alaska. As of July 1, 1946, the total number of refuges was 291, with an aggregate of 17,819,495 acres. Of these, 271 refuges, with 9,889,856 acres, are in the United States. All wildlife is protected on these refuges, but some units are for special purposes. At the

Photo by Francis M. Uhler

FOOD HABITS LABORATORY, PATUXENT RESEARCH REFUGE, MD.

present time 201, with 3,213,658 acres, are classified as migratory waterfowl refuges; 49, with 91,483 acres, mostly small islands are for colonial nongame birds; 16, with 10,642,015 acres, are for big game; 24, with 3,870,156 acres, are for migratory birds and miscellaneous forms of wildlife; and 1, the Patuxent Research Refuge, of 2,623 acres, is maintained entirely for wildlife experimental purposes. This land has been purchased from emergency funds and duck-stamp receipts, received by gift, or has been taken from the public domain. Much of it is relatively undeveloped from a wildlife standpoint and can be made more productive as funds become available. Even when money is available, it takes time to get the full biological advantage of water impoundments, plantings of various food plants, and other management measures that are used in building lands toward the greatest possible wildlife production.

One who did not live through the period of acquisition and development of these lands in the hectic days of the late thirties can have little conception of the immense volume of work required before such a program can be accomplished. Much of the acquisition that came after 1935 was due to the program initiated by Darling during his brief but fruitful career as Chief of the Service, and very much of the credit should go to him. Likewise, some of the lands acquired but not yet under administration and new refuges projected will become accomplishments of the future.

It takes more than building a dam or other water-control structure and flooding a piece of land to make a waterfowl refuge. Many things happen between the time the area is flooded and the date when the new marsh becomes capable of maximum production of waterfowl food and habitat. The development of the refuge system helped in the restoration that approximately quadrupled the continental waterfowl during the period between 1935 and 1944. Almost every area developed had been either completely de-

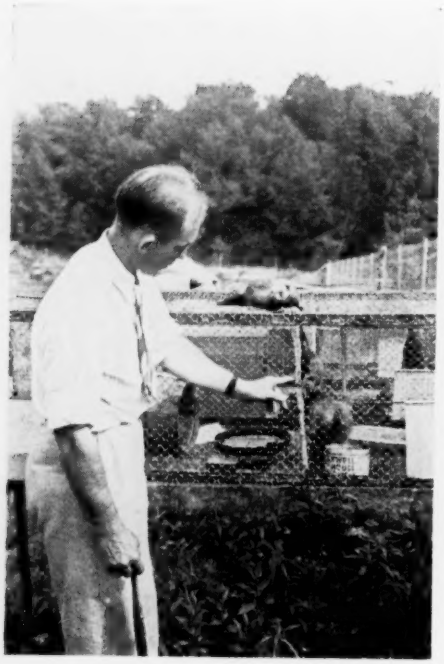


Photo by Wm. Schmidtman

EXPERIMENTAL ANIMALS

FERRETS KEPT ON PATUXENT RESEARCH REFUGE, MD.

stroyed by ill-advised drainage, or its production had so decreased that it was feasible to buy and restore it to productivity. In many cases the restored area represented the dream of one or more local conservationists. It is only necessary to mention Malheur Lake, Horricon Marsh, Lower Souris, Mud Lake, or the Montezuma Marshes to bring understanding to those acquainted with the lands.

One of the outstanding accompaniments to the refuge program was the development of successful techniques for harvesting, handling, storing, and planting seed and bulbs or other vegetative parts of waterfowl food plants. These methods are now routine practice, with a high percentage of success.

The physical development of these refuges, in retrospect, is a confused medley of building water controls and diversions that local wiseacres sometimes said could not possibly work but did; of building sand fences with the aid of the winds and the C.C.C. camps; of daring and ingenious applications of development schemes in a field where it was necessary to pioneer; of building fences and dikes; of planting aquatic plants and upland trees and shrubs; and doing the innumerable other things necessary to turn a piece of poor and largely nonproductive land into something of growing usefulness to the community and the nation. It took faith and long vision to undertake many of the projects, and the men in the Service had both in abundance.

Including the habitat available for waterfowl on refuges not tabulated as waterfowl refuges, it is probable that the total land dedicated to waterfowl usage on Federal refuges is approaching the halfway mark of the 7,500,000 acres originally outlined by Darling in his conception of the minimum needs of waterfowl. Developments during the past two years, including the quick drop of migratory waterfowl populations with additional shooting pressure and less favorable breeding seasons, emphasize the need for making available additional marshland to provide food and cover over more widely dispersed areas than now exist if the waterfowl resource is to be managed wisely.

Better cooperation between state and Federal conservation agencies. Again it is possible to report real achievement. Nine cooperative Wildlife Research Units, involving the four-way cooperation of the state conservation departments and agricultural colleges of the states in which they are located, the American Wildlife Institute, and the present Fish and Wildlife Service, were established in 1936. Later an additional unit was added. These Units are doing better work than ever, although their programs were sadly disrupted during the war period. They were originally set up as cooperative research and demonstration programs. The research could be either short- or long-time projects, and definite efforts were to be made to put the findings into use on the land by developing demonstration areas. Around these Units

Photo by Wm. Schmidtman

LAKE CONSTRUCTED BY C.C.C., PATUXENT RESEARCH REFUGE, MD.

there quickly developed a program of undergraduate work in some of the schools, and all of them did work in training technical personnel. Whatever the value placed on the fact-finding and educational work accomplished, it is my opinion that the greatest contribution has been the development of five or six hundred well-trained young men who are now working in the wildlife field with a lifetime of productive effort still before them. From the beginning of this program the Service made definite efforts to help state conservation departments. The number of cooperative surveys and studies carried on with various game departments on specific problems of immediate concern to them has been great. Exchange of information between Federal and state technicians is now a common practice. Many states regularly detail men to the Patuxent Wildlife Research Refuge to use the facilities there and to have the benefit of working with other men in the same field. Since this was one of the hopes when Patuxent was visualized, it is very gratifying to see it develop.

The Pittman-Robertson Act, passed, and signed by the President, on September 2, 1937, was the greatest single wildlife conservation measure passed in the period under review. In outlining the program it was suggested that Federal-aid legislation on a basis similar to that of the Highway Aid Act was a necessary part of a sound conservation program. The act passed was much more comprehensive than the one visualized at the time the suggestion was made. It authorized three types of projects: purchase of land, development of land, and research that would improve the efficiency of wildlife administration in the state.

Although the war came on just as this program was well started, its accomplishments indicate that it is sound. All states except Nevada have qualified under the terms of the act. In the Western states programs have stressed big-game problems. Many of their land purchases have been made to secure winter range for troublesome big-game herds. Many Western states have also developed good small-game and waterfowl proj-

ects. The first project after the Pittman-Robertson Bill became a law and funds were available was a marsh development in the state of Utah. Midwestern and Lake states have devoted their funds largely to work with quail, pheasants, and rabbits. In several states the funds have been used to purchase small scattered areas for building ideal habitat for farm game. Others have leased these areas and developed the habitat. In the South the major emphasis has been on quail, with wild turkeys and deer receiving some attention, and the mourning doves becoming a major project in one or two states. In the Northeastern states deer, ruff grouse, and pheasants have had more consideration. Waterfowl projects have been scattered throughout the country. State men are finding that a combination of waterfowl and upland game projects, where possible, are convincing demonstrations to the public of the value of wildlife restoration. The construction of a lake or the restoration of a lake or marsh is a spectacular local event. When it is flooded and the waterfowl commence to use it, everyone can see it. An equally good job of restoring habitat for upland game and any game increase are much less noticeable to the public.

The lands acquired under this program already provide a substantial additional area primarily for wildlife use. As the years pass these state-owned and -managed wildlife lands will grow in relative importance.

There was one element of the proposed cooperation between state and Federal wildlife agencies on which little progress has been made. This was a cooperative educational program comparable to the present forest extension program. So far no authorizing act has been passed by Congress. This does not mean the educational effort has been neglected, but it has been largely part-time work by men occupied with other assignments. The Fish and Wildlife Service is now authorized to cooperate in almost any way with state wildlife agencies. However, unless men having the special training necessary to translate the results of research into terms that landowners can understand are available, the job cannot be done effectively.

Closer coordination of Federal activities. In outlining this need it was stated that little difficulty was experienced in securing coop-

Photo by H. H. T. Jackson

HEADQUARTERS BUILDINGS, MALHEUR NATIONAL WILDLIFE REFUGE, ORE.

MARSH AREAS OF LAKE MALHEUR BIRD REFUGE, ORE.

BULRUSHES AFFORD FOOD AND COVER FOR MANY SPECIES OF WILDLIFE.

eration between the major conservation organizations. The real need for coordination was between conservation and other Federal agencies whose activities often vitally affected conservation programs. Such organizations as the Army Engineers, the Reclamation Service, and the Public Health Service, in its mosquito control operations, were those particularly in mind. In the beginning, there was much difference of opinion over the necessity for marsh drainage for mosquito control, and more over the methods used. As a result of cooperative research there has been definite improvement; mosquito control methods much less destructive to wildlife have been developed. These better methods are not yet used by all local agencies, but there is less destructive activity in the marshlands.

The coordination act passed in 1934 provided an opportunity for the Fish and Wildlife Service to cooperate with Federal agencies developing flood control, hydroelectric reclamation, irrigation, and navigation projects. Cooperation was largely voluntary, however, on the part of the agencies concerned. There was no feasible method for either the Bureau of Fisheries or the Biological Survey to make their voices heard effectively unless the man in charge of a particular project was interested in conservation problems. Consequently, plans were often completed and construction under way before any consideration was given to the fish and wildlife problems caused by a project. By constant effort the Fish and Wildlife Service became so much of a nuisance by 1944 that better voluntary cooperation was forthcoming from the agencies working in water impoundments. By 1945 the Service was receiving complete cooperation. It now has the opportunity to see preliminary plans of both the Army Engineers and the Reclamation Service and is often able to make field surveys on funds furnished by these agencies.

Photo by P. J. Van Huizen

DUCKS AT "THE HOLE," SACRAMENTO NATIONAL WILDLIFE REFUGE, CALIF.

In July 1946 a new coordination bill, the Robertson Bill, wrote into law the cooperative practices now being followed between the Federal agencies. This act also gave the state conservation departments an opportunity to have their staffs work on these projects. This law does not and should not give to either state or Federal conservation agencies veto power over any project. It does give the right to protest any project as vigorously as desired. Reports and recommendations of the agencies go to Congress with those of the engineers at the time the appropriations are requested. At least Congress will have before it the effects of the proposed development on fisheries and wildlife as well as the usual engineering reports on the benefits to be derived from such developments. Because of this law closer coordination of Federal activities has been achieved both in practice and in terms of legislation. Perhaps success has come here to a greater degree than in any other objective.

Recognition of wildlife interests by public and private land-management agencies. National forests and the public grazing lands are the most important public lands from a wildlife standpoint. The national forests hold much of our remaining big game and provide a large share of the most valuable trout waters. The grazing lands are important to antelope, sage hens, and many of the Western quail. The Taylor Grazing Act and the formation of the Grazing Service made it possible to administer this land for the purpose of restoring badly overgrazed lands. Several states have worked with the grazing associations and the Grazing Service to develop better distribution of water for both wildlife and livestock. Springs have been developed and fenced, and water piped into troughs outside the fence. The stock do not trample the waterhole; the wildlife, particularly birds, get the benefit of the additional cover inside the fence; and both benefit by the additional water provided.

The National Forest Service has for years been conscious of forest wildlife values. Perhaps more than any other agency administering lands primarily for other purposes, it has tried to make provision for wildlife. As a result much big game and many small wildlife forms have greatly increased on the national forests. Many other state and national land-administering agencies are following these examples to some degree.

Progress has been made in interesting public land-administering agencies, but the effort to interest private landowners in the values of wildlife has been less successful. The establishment and development of the Soil Conservation District Program has been responsible for such progress as has been made. The Soil Conservation Service has been vitally interested in restoring to permanent vegetation badly eroded lands and other types unfit for farming. Wherever plants useful to wildlife were available, they have been used in the permanent vegetative program. A great opportunity is now at hand for developing wildlife practices in organized Soil Conservation Districts, and perhaps progress may be greater in the next ten years.

Pollution control. For a time during the thirties real progress was made in pollution control. Hundreds of sewage treatment plants were installed, and pollution was decreasing in numerous areas. Construction of sewage disposal plants was slowed down or stopped entirely during the war. Many new industrial plants using new chemicals that produced new pollutants were built, resulting in the pollution of many previously undefiled streams.

One of the serious handicaps to a better control of pollution from a fish and wildlife standpoint has been the fact that there were no standards by which pollution from a biological viewpoint could be judged. The tests used were based on public health requirements. Many industrial wastes, relatively unobjectionable from a public health standpoint, are exceedingly destructive to aquatic life. Both fisheries and wildlife values are involved, since pollutants that destroy the smaller aquatic forms of life or kill the aquatic vegetation may affect both groups, although they may not kill fish or wildlife directly.

The Bureau of Fisheries had been working for years on these problems. With the appearance of new pollutants from war industries, additional funds were given the Serv-

Photo by P. J. Van Huizen

PINTAILS AND MALLARDS, SACRAMENTO NATIONAL WILDLIFE REFUGE, CALIF.

ice. Traveling laboratories were built and assigned for experimental testing of the effects of new chemicals and their waste products upon aquatic life. One consequence has been the publication by the Fish and Wildlife Service of a bulletin entitled *The Determination of Water Quality*. For the first time definitions and tests are provided that can be used for determining when pollutants of certain types are present in a degree harmful to wildlife. Corrective measures are also outlined as far as possible, although complete methods are not known for treating all industrial wastes. Even though the total amount of pollution may have increased, there is now better and more usable knowledge with which to combat it.

Wildlife research program. Here again progress can be reported. Despite the war and the interruptions caused in the work, much valuable new information is available. Discussing first the work of the Service itself, it can be said that research appropriations now are greater than in 1936. These are difficult to estimate accurately because wildlife research is carried on both by direct appropriations and by projects paid for by cooperating agencies.

One of the main values of a research unit lies in having highly trained technicians able to devise techniques and methods for solving new problems. The Service has been able to use these men in investigations of immediate problems not once but many times.

Perhaps the major physical advance has been the acquisition and development of the Patuxent Wildlife Research Refuge near Bowie, Md. Lying only 20 miles from Washington, this 2,600-acre tract of land, with adequate laboratories, is the first National Wildlife Research Station. For the first time research personnel had available buildings designed for research purposes and equipped with proper apparatus. Along with the development of this station, substations have been developed at the Bear River Marshes and at the Wichita Wildlife Refuge in Oklahoma. Small field laboratories, with facilities

Photo by C. J. Henry

LOWER SOURIS (N.D.) HEADQUARTERS FROM THE MARSH

Photo by Greenwalt

ANTELOPE ON THE CHARLES SHELDON ANTELOPE REFUGE, NEV.

for preserving and handling material gathered in field studies, have been provided at most of the major refuges.

The Patuxent Station has undertaken long-time studies secure in the knowledge that these lands are permanently available. There should be a great increase in the basic research work as a result of these increased facilities. It would be difficult to pick out the outstanding research results or even to list the principal accomplishments in a short article. Among them, however, are the development of better methods of propagating and handling valuable aquatic plants, better methods of controlling such pests as saw grass and water chestnut, and the accumulation of knowledge of better methods of marsh management. Other outstanding research achievements in recent years have been the cooperative investigations with various mosquito control organizations, which have resulted in less damage to wildlife; the improvement of the annual surveys of waterfowl conditions and populations; the work on mourning doves at the Alabama Cooperative Unit, which furnished information on which administrative action curtailing September shooting was based; the white-winged dove studies, which resulted in definite management programs of cooperation by the Service and the states involved; and the studies on the Attwater prairie chicken in Texas, which resulted in a complete closure of the season by the Texas conservation authorities. Many studies on the facts that determine the success or failure of conservation of upland game, waterfowl, and fur-bearing animals in various sections of the country have been furnished, and definite techniques developed, to help in the better management of the various species of wildlife involved.

One of the most interesting and practical developments came from the continued study of botulism, which has resulted in methods of preventing or controlling outbreaks of this disease that are applicable to many areas. Another series of studies has

provided methods of using fire in marsh management. Fire can be used to control undesirable vegetation under certain conditions, the time and method of burning having much to do with success or failure. Many experiments have been made to determine the effects of variation of water levels on different types of plants, both noxious and desirable. The practical management of the marshes where water levels can be controlled or manipulated is now more certain and much less costly.

Considerable progress can be reported in developing new means of securing better forest reproduction in areas where destruction of seeds or seedlings by birds or mammals has been serious. New and more specific methods of control of destructive mammals have been developed and tested, one of the most interesting being the discovery that birds discriminate against certain colors and that ground squirrels and prairie dogs do not. Coloring of grains used in poison baits has provided an additional safeguard for valuable birds. It is impossible to enumerate all the various projects in which progress has been made. Rather, I have endeavored to mention some of the various types of studies that have produced results.

Laws and regulations for protection of wildlife. No wildlife management program can be successful without provisions for managing the harvest. Regulations governing the taking of birds and animals should be formulated upon the needs and condition of the wildlife population rather than upon the desires of those who take it. The Service, in recommending the waterfowl regulations and those for both fisheries and game in Alaska, endeavored to follow this basic principle. This has not been completely successful, but partly, at least, as a result of these efforts the public more willingly accepts the ideal as a goal toward which both state and Federal conservation agencies should work. Real progress has been made in advancing this concept. Many state game departments are now operating under laws that give them authority to make regulations based upon the wildlife conditions that prevail each year. In a growing number of states such programs are being carried on more or less successfully. They have often been handicapped by lack of trained men, a handicap slowly being overcome as trained men return from the armed services and new men begin to come from the schools.

The Fish and Wildlife Service's efforts to secure an adequate staff to enforce the waterfowl regulations have not been successful. Although the appropriation for this purpose has increased in the past ten years, it has not been sufficient to enable the Service to cope with the tremendous increase in the number of waterfowl hunters. Lack of adequate law-enforcement staffs is still one of the great weaknesses of the Fish and Wildlife Service, and the same is true of many state game departments. In some states funds are sufficient to maintain an ample staff, but state pay scales, restrictive employment laws, or political handling of employment make it impossible to hire competent men. Even the states that have the best enforcement records do not have adequate staffs to control the growing number of violations. Law observance is still a major need if the wildlife resources of the country are to be intelligently managed.

FISHERIES PROGRAM

It is not so easy to outline the progress made in the fisheries program, since my close contact with it goes back only to July 1, 1940. It is evident, in examining reports for the period 1936–40, that the program resulted in building and equipping new laboratories, in expanding research programs, in repairing and modernizing old hatcheries, and in building additional hatcheries.

Since neither the Bureau of Fisheries nor the present Fish and Wildlife Service have regulatory authority over the taking of the fish within the continental United States,

any improvement in the protection of existing fishery supplies has been made by the states. Contributions of the Federal group have been largely in research. For example, they have studied the effects of planting various-sized fish in the streams and waters of this country. In the eastern United States they found that planting small trout was useless in many streams. Federal hatcheries and some state hatcheries are planting fewer and larger fish as a result of these findings. Similar investigations in the Great Lakes in commercial and sport fisheries indicated that the depletion of many species was due to a combination of overfishing and inadequate law enforcement. This was confirmed by extensive hearings held by the Great Lakes Fishery Inquiry group established cooperatively by Canada and the United States. The studies and hearings resulted in the negotiation of a Great Lakes Fishery Treaty—a new departure in state, Federal, and international relationships. State governments were consulted freely in developing the treaty and are provided a voice in its administration to a greater extent than has previously occurred in any international convention. This treaty should be ratified promptly, since it provides machinery for regulation of the fishing in a lake or a section of a lake according to the existing biological conditions rather than regulation by state or international boundary lines. This treaty, if ratified and if suitable enabling legislation is passed, can not only prevent further deterioration of the fisheries but can gradually rebuild some of the former values.

The development of fishery resources in interior waters has been greatly accelerated by the farm pond program, an integral part of the soil erosion work of the Soil Conservation Service. Many thousands of farm ponds have been stocked by Federal and state hatcheries in a cooperative program, resulting in the development of thousands of new fish-producing areas.

At the same time the Federal fish hatcheries in interior states have devoted their major efforts to producing sport fish. In mountain areas trout have been the principal species, and bass, crappies, bream, and catfish have been the main species propagated and distributed in the valleys.

Since the formation of the Fish and Wildlife Service the hatcheries division has been reorganized and staffed with technicians so that the fish produced can be planted in suitable waters and have a maximum chance of survival. Coordinated programs with the states have made it possible to distribute fish at less cost and ensure that only fish suitable for the type of water are planted. This should lead to the maintenance of better stocks of fish and to better fishing.

Because of the heavy fishing pressure on the Eastern trout waters, it is not possible to meet the demand except by restocking several times a season. The tendency is to plant fewer and bigger fish, preferably those of legal size. Research studies showed this to be the most practical method of meeting the need.

Similar efforts are not needed with warm-water fish. Their rate of reproduction is greater, the food supplies in the warmer lowland waters are relatively more abundant, and the quantity of fish that may be produced greatly exceeds that of an equal area of trout water.

The reclamation of fishing waters was a project on which considerable progress had been made by reducing pollution in many streams. The war not only stopped construction of many sewage reduction and industrial waste treatment plants but brought a great many new war plants into existence. Many of these used new chemicals and poured into the streams new pollutants whose effects were not known. As a result there are now probably more waters polluted than ever, since many of these plants poured their effluents into hitherto unpolluted water.

Pollution is a major postwar problem that must be attacked with renewed vigor. Fed-

eral legislation is needed to get at those cases of pollution where action by one state will not suffice to clean up a stream. These cases may fall into two categories: where the streams form a common border of two or more states; where a stream rising in one state may be polluted as it enters a second state even though the latter makes every effort to keep the waters clean.

Although the fisheries research staff had accomplished much, there was no group in the Service whose work was more handicapped by the war. Many men were called for war duty in the Office of the Coordinator of Fisheries, in other civilian war agencies, and in the armed forces. This represents a permanent setback in time for much of the basic program. In addition, for the first time in many years it had been possible to get oceanic research boats under construction. One, furnished by the fishing interests of the North Atlantic, was being equipped for offshore research work. This boat was taken by the Navy, altered for naval use, and will now require other alterations before it can be used or research purposes. A second research vessel was on its way to Alaska for fur seal work. It had been completed, equipped, and staffed with biologists and a crew when the Navy took it. That boat is again available, stripped of most of the equipment with which it had been fitted; a major job of overhaul will be necessary before it can be used. The fact that these boats are still not usable after five years represents a distinct loss in securing basic data to meet conservation problems in the two areas.

The completion of the Little Port Walter Pink Salmon Station in southeastern Alaska was another forward step. This station, built with weirs to count adult fish in and fry out of the stream, is the first available to the Service. It operated during the war period and has already furnished invaluable information regarding the expected runs of fish. The value of the station will grow as basic data accumulate, but several substations scattered throughout the southeastern Alaskan pink-salmon area are needed before an adequate job can be done.

It is not possible to mention all studies that have led to definite management recommendations. As a result of studies of the lobster populations, Service biologists recommended an increase in the minimum legal size limit for taking lobsters. This limit was adopted by the major lobster-producing states some years ago. Its adoption and enforcement have been accompanied by a great increase in the lobster catch, and it is believed that some of this increase is a direct result of the recommendations.

Similar investigations of the striped-bass population of the North Atlantic resulted in a recommendation of a minimum length of 16 inches. Many states have already enacted the legislation recommended, although two of the most important, Virginia and Maryland, have not. They have raised the minimum size limit somewhat, but still not enough to ensure the escapement of adequate spawning stock.

Shad studies carried out in various rivers resulted in recommendations that a greater escapement of shad to the spawning grounds be allowed. In the Hudson River, as a result of a management program, the shad catch has increased from something like 40,000 pounds a year to over 4,000,000 pounds. A spawning escapement of 50 percent of the adult fish occurs in this river, and 40–50 percent escapement of adult shad has been recommended for all shad streams. Few states have adopted this recommendation, although Maryland, under a new fisheries regulation, has been building toward an adequate escapement, with an increase already noticeable in both the shad population and the commercial catches.

Maryland has adopted a rather revolutionary fisheries law which freezes the number of commercial fishing licenses and provides for a gradual reduction in their number over the years. This law was based on a rec-

ommendation growing out of research on the Chesapeake Bay fisheries by Service biologists.

In the commercial fisheries field similar accomplishments have been achieved by the technological workers. There are now laboratories in Ketchikan, Alaska; Mayaguez, Puerto Rico; College Park, Md.; and Seattle, Wash. In addition, two traveling laboratories are in use on the Atlantic coast. This group did pioneer work on the king crab in the Bering Sea. As a result, a number of commercial organizations are now engaged in experimental fishing for this crab. Although formerly caught almost exclusively by the Japanese but sold largely in the American market, there is no real reason why American fishermen should not take, and American workmen process, these giant crabs.

Technological research work was greatly curtailed by the necessity of doing war emergency work. Despite these difficulties, work was continued on vitamin A. Much was done to find new sources of this vital commodity and to develop better methods of handling and sampling shark livers. In fact, a sampler developed by a Service research man is now widely used commercially. Much was also done to develop methods of processing fish that could not previously be successfully handled.

Few people appreciate the handicap under which the commercial fisheries operated during the war. At the outset the armed forces seized for auxiliary use some 700 of the largest, newest, and best fishing boats, thus reducing the efficiency of the fleet much more than the actual number taken would indicate. In addition to the shortage of manpower and supplies common to all industries, the fisheries quickly found themselves in direct competition with the Navy for marine motors and small-boat equipment and with the Army for twine for fishing nets. The industry managed, however, to hold production at almost normal level. Where there was a special need for certain products they even succeeded in increasing production. Many of the Service research workers became key men in meeting war problems. Their technological work was directed at immediate problems, and they often came through quickly with the solution. One way in which greater production was obtained was by developing methods of handling and marketing fish not previously utilized. Many of these fish will probably find some permanent place in American markets. This will make possible a constant supply of fish and at the same time a conservation program to build up any depleted fishery. The nation is slowly realizing that, although the bounty of the ocean seems inexhaustible, there is a limit to the number of pounds of any one fish that can be taken. This limit may be imposed by the increasing cost of taking additional fish or by the biological conditions of the stock itself.

The clearest case of this kind has developed in the haddock and pollack fisheries on the Georges Bank off Cape Cod. Because of its nearness to markets this Bank has been overfished for years. Studies carried on by Service biologists have shown that the deciding factor is the removal of too many fish of less than 2.5 pounds. These fish are taken before they have passed their period of maximum growth and also before they have spawned. Exhaustive studies of these populations have shown that the number of fish can be increased by permitting the escapement of as many 2.5-pound fish as is possible by using larger-mesh nets. If such a program could be carried out, within five or six years this Bank would produce 100,000,000 pounds more fish annually. A voluntary program was undertaken, and results were beginning to become apparent when the war demand for food stimulated a greatly increased market for these immature fish. This means that unless some agency has authority to make and enforce the necessary regulations it will be difficult, if not impossible,

to develop a sound management program.

The Service has endeavored to carry out the principles of the 1936 statement in Alaska. It has tried to maintain the stocks and to obtain the widest possible utilization of the products of the fisheries. It has not been entirely successful. During the war years many of the personnel were lost from the Alaskan Service. This loss, coupled with the high price of fish and the pressing demand for canned salmon, has made it impossible to carry out an effective law-enforcement program. In several areas the salmon stocks are seriously depleted despite the most vigorous attempts at sound management. The reduction is most marked in the pink salmon in southeastern Alaska, but these somewhat erratic fish may be expected to recover more quickly under proper protection than the depleted runs of red salmon further to the west. Since red salmon run in four- or five-year cycles instead of two, it takes a much longer period of years to build up depleted runs.

The herring populations had been successfully rebuilt so that it was possible to greatly increase the take during the war as the results of several previous years of conservation became effective. Just prior to the war all herring fishing was stopped in southeastern Alaska for several seasons, and greatly reduced quotas were allowed in Prince William Sound and the Kodiak area. After several fairly successful spawning years, the herring became much more abundant in 1943–45, when fish oil was most needed.

The very successful program of the International Fisheries Commission in building up the halibut population from the low point reached about 1930 also made it possible to permit an increased take each year without interfering with the valuable rebuilding program.

In retrospect, I find that my years at the head of a conservation organization were exciting ones. In general I believe they were years of real advances, especially prior to our involvement in the great war. From 1935 to 1941, there were tangible accomplishments and there was much that is permanent. The war years were spent largely in protecting the gains made during the more constructive times and in handling the many war problems that came in the wildlife and fisheries field. It is my belief that the wise use and careful management of our natural resources, including wildlife, is now more than ever a national necessity. It is increasingly important that we do a better job in view of the increasing demands on all resources. This will be difficult to do, particularly in the face of the "economy program." I am sure of one thing, and that is that the personnel of the Fish and Wildlife Service and other conservation agencies will do their best to accomplish that objective regardless of all obstacles.

THAT MORE PEOPLE MAY LIVE BETTER

By CHARLES MORROW WILSON

Mr. Wilson (B.A., University of Arkansas, 1926) is a journalist who specializes in reporting and appraising tropical countries. In December 1946 he returned from a trip to Equatorial Africa—a trip he described as "a magnificent adventure." He had previously visited and worked in Liberia during 1945. Mr. Wilson is a director of the American Foundation for Tropical Medicine. In June of this year he received the official citation of distinguished alumnus from his alma mater.

AMERICAN scientific interest in the tropics, as the perennial reservoir of raw materials and the home of almost half the human race, takes a new forward step with the establishment in Liberia of an international medical research center.

This institute is under the sponsorship and direction of the American Foundation for Tropical Medicine, Inc., the administrative affiliate of the American Academy and the American Society of Tropical Medicine and a nonprofit corporation with headquarters at 270 Madison Avenue, New York.

The research institute, which will be built and equipped during 1947–48, is to be located in Liberia, the only African republic, at a point about three miles from Roberts Field, the major land air base of West Africa. Its site is near the Farmington River, a few miles inland from the port of Marshall, and about 50 miles upcountry from Monrovia, the Liberian capital.

Harvey S. Firestone, Jr. has granted $250,000 to the Foundation for use in constructing the primary buildings and purchasing basic equipment for the institute. The Republic of Liberia, by authority of its president, William V. S. Tubman, has donated 100 acres of highly desirable land as a site for the research center and has granted an option for an additional square mile of land which the institute may develop as a livestock range.

The American Foundation for Tropical Medicine, whose membership and directorate include prominent businessmen as well as leaders in the various fields of tropical medicine, is under contract with the Liberian government to maintain and supervise the research institute for a period of five years, and to direct and assign research projects with the assistance of a qualified resident director and staff, to appoint personnel, to disseminate findings to interested scientists of any nation, and to grant research fellowships to deserving scientists without restrictions as to race, creed, or color.

The scientific advisory committee for the Liberian Institute consists of the following representatives of participating institutions, which are members of the American Foundation for Tropical Medicine:

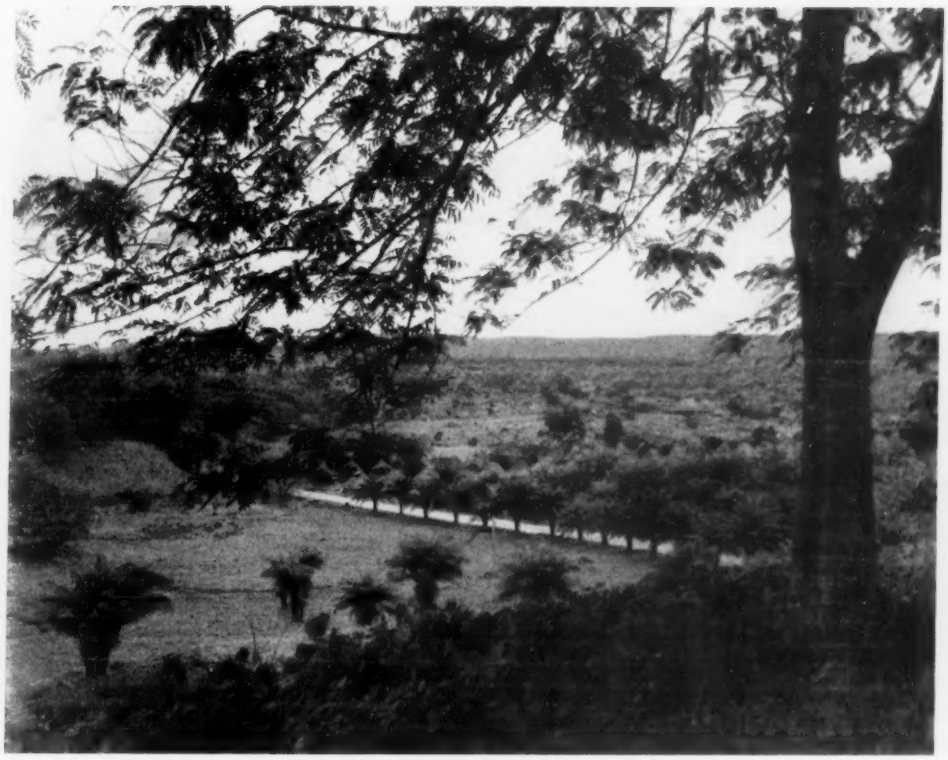
Dr. Herbert C. Clark, Director, Gorgas Memorial Institute (Panama)
Dr. Hamilton H. Anderson, California
Dr. Rodney Beard, Stanford
Dr. George C. Shattuck, Harvard
Dr. James S. Simmons, Harvard
Dr. Malcolm Soule, Michigan
Dr. William Taliaferro, Chicago
Dr. Carroll E. Roach, Director, Eli Lilly and Company Research Laboratories
Dr. Edward I. Salisbury, Medical Director, United Fruit Company
Dr. James A. Shannon, Director, The Squibb Institute for Medical Research
Dr. Donald S. Martin, Duke
Dr. Henry E. Meleney, New York University
Dr. Thomas T. Mackie, Bowman Gray School of Medicine (President of the American Foundation for Tropical Medicine)
Dr. Perrin H. Long, Johns Hopkins
Dr. Justus B. Rice, Winthrop Chemical Company

Dr. Joseph L. Johnson, Howard
Dr. E. Carroll Faust, Tulane
Dr. James N. De Lamater, Southern California
Dr. Jean A. Curran, Long Island Medical College
Dr. Sterling Brackett, Director, American Cyanamid Research Laboratories
Brigadier General George R. Callender, Army Medical College
Dr. Harold W. Brown, Columbia
Brigadier General Raymond A. Kelser, University of Pennsylvania

The Liberian Institute is launched as a major enterprise of the Foundation, whose current work program includes the sponsoring of medical school courses in tropical medicine; extensive grants to the Tulane School of Medicine (which now maintains the only graduate department of tropical medicine available within the United States); granting of fellowships at Tulane for talented graduates of Latin-American medical schools; also grants-in-aid for the publication of noteworthy critiques and reports in the field of tropical medicine, including partial support of such scientific periodicals as the *Journal of Parasitology* and *The American Journal of Tropical Medicine*.

As the major project of the Foundation, the Liberian Institute will stress international cooperation in tropical study. Dr. Thomas T. Mackie, who is President of both the Liberian Institute Corporation and the American Foundation for Tropical Medicine, Inc., is receiving assurances of cooperation from the schools or departments of tropical medicine of London and Liverpool Universities; the Hamburg Institute; the Swiss government medical academy; the Belgian government; the Riff Valley Institute, of the Belgian Congo; the Louis Pasteur Institute, of Paris, which maintains African field stations in Algeria, Tunisia, and at Dakar; and the Liverpool School of Tropical Medicine's renowned West African field station located in the British colony of Sierra Leone. In addition, many government and military medical services, including the Medical Corps of the U. S.

NATIVE VILLAGE NEAR HARBEL, LIBERIA



TYPICAL LIBERIAN COUNTRYSIDE

NEAR THE NEW LIBERIAN INSTITUTE FOR RESEARCH IN TROPICAL MEDICINE.

Army and Navy, and the U. S. Public Health Service, have expressed interest and willingness to cooperate in the research projects planned or contemplated for the new Liberian center.

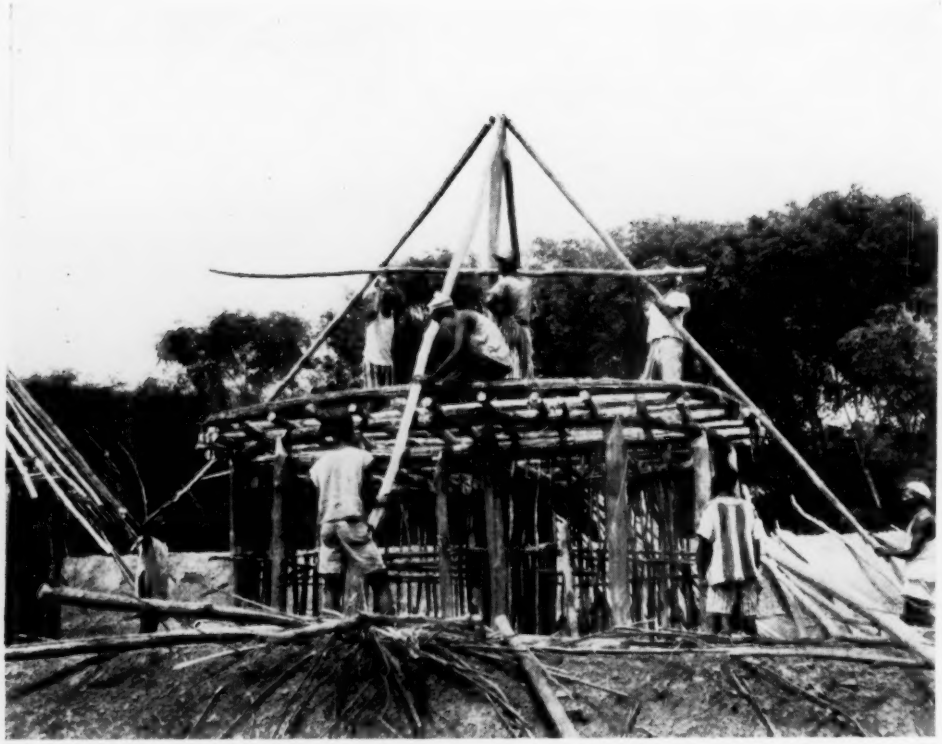
Surgeon General Thomas Parran, of the U. S. Public Health Service, recently stated in a letter to Dr. Mackie:

> . . . In my opinion no single effort in this field [of tropical medicine] is more worthy of wholehearted support. . . When we consider the fact that just one tropical disease—malaria—constitutes the number one world health problem, we know there still is a big job to do in this sector. When we further realize that distant points no longer exist in the world—that this indeed is one world—we also know that it can be a world of disease or a world of health, depending upon how vigilantly we in medicine work for freedom from disease. . . .

The executive committee of the Liberian Institute announces that all reasonable efforts will be made to make the Liberian Institute available, even during its earlier stages, as a hospitable working headquarters for qualified scientists previously or otherwise interested in carrying on independent research in fields related to health and nutrition in the tropics.

The resident staff will consist of a director, assistant director, and a skeleton research staff, which will probably include a chemist, pathologist, parasitologist, pharmacologist, and other members as required. The staff will thereafter be supplemented by grants of fellowships and exchanges as directed by the scientific and medical advisers of the American Foundation for Tropical Medicine.

The institute's projects will include research and experimentation with regard to



AFRICAN-STYLE HOUSE-RAISING

the feeding, husbandry, and pathology of tropical livestock, particularly poultry, cattle, and work animals. The Foundation is convinced that improvement of animal husbandry in tropical countries is a salient requirement for adequate human nutrition in practically all tropical countries. The chronic lack or insufficiency of beef, milk and other dairy products, fowls, and eggs accounts for the common inadequacy of protein foods in tropical diets. This has long been a primary concern of tropical medicine. Also, the possibilities for improving livestock resources in tropical countries are otherwise basic to the development and well-being of those countries. For example, healthy draft animals are required for supplying the power necessary for realizing the vast potential productiveness of tropical soils. In hot-weather countries with heavy rainfall, animal manures are particularly valuable for replenishing and perpetuating soil fertility. Furthermore, many of the domestic animals, if sickly, serve as reservoirs or hosts to serious human maladies or in other ways facilitate the spreading of disease among peoples. It is also true, as in the instance of certain types of malaria and trypanosomiasis, or African sleeping sickness, that common domestic animals suffer from types of disease organisms similar to, and in some instances actively related to, organisms that cause human diseases.

Numerous medical authorities agree that Liberia, located in the highly verdant rainforest belt of West Coast Africa, at a latitude ranging from 4° to 7° north, is an excellent vantage point for such a research center. The area has long been an endemic center for malaria, sleeping sickness, and many other parasitic diseases; also for yaws and other spirochete diseases; numerous

dysenteries, some of which are not yet classified; tuberculosis, filarias, including elephantiasis and schistosomiasis; and many virus diseases. The institute's site is well-drained agricultural land, accessible to highways, power lines, and a radio telegraph station, and near to varied and typical tropical terrains, including swamps, river valleys, and hilly lands.

As the only republic and one of the two sovereign nations of present-day Africa, Liberia has assured the ready admission of holders of accredited medical licenses from all nations and all other bona fide scientific workers. The Liberian people, numbering about 1,600,000 and for the most part members of 21 indigenous tribes, are respected as one of the most cooperative and peace-abiding of publics. In its hundred years of sovereignty Liberia has never had a revolution, suffered a major civil war, or by-passed a lawful election. In terms of credit and debt status, as well as law enforcement, the Negro republic has earned the respect of all nations.

The Liberian Institute is being, and will be, supported by grants and contributions from American industries and business and educational establishments interested in the development of tropical trade and the specific improvement of international relations. Thus far most of the commercial firms that contribute to the institute are either drug and pharmaceutical houses (which recognize that the Liberian Institute will provide a strategic center for the practical testing of new agents and drugs, as well as established pharmaceutical products) or major concerns such as United Fruit Company and Firestone Tire and Rubber

TYPICAL FARM HOME IN LIBERIA

Company, which operate extensive properties in the tropics.

At present the American Foundation for Tropical Medicine is seeking to broaden the bases of sponsor interest on the grounds that tropical medicine is essentially international medicine. Relatively few of the so-called tropical diseases are confined to the tropics. The great majority, including malaria, the No. 1 communicable disease of the world today, leprosy, dysenteries, tuberculosis, and many others, are world-wide enemies which, like almost innumerable species of plants and animals, have taken refuge in tropical lands whose climates and environments tend to minimize the risks of survival.

It follows that in the world of today, in which there no longer exist truly distant places, wherein any habitable area is within 60 flight-hours of any other habitable area, diseases in the tropics actively menace the health and economy of all peoples without regard to locale or latitude. Nowadays, indeed, any one of us can contract a disease in the tropics, return home by plane, and go to our work for several days or weeks before actually "taking down" with the disease. And, ironically, as the medical section of the United Nations has recently pointed out, present-day facilities and technologies for quarantine are gravely inadequate to meet the prevailing needs of the global war for human health.

THE importance of tropical medicine to world trade is likewise stressed by the Foundation in planning the new research center in Liberia. It is common knowledge that in the tropics or elsewhere unhealthy

LINE OF RUBBER TAPPERS, HARBEL, LIBERIA

people cannot work or produce effectively and therefore do not prosper. The truth is, too, that in tropical countries good health is not inherent, cannot be taken for granted, and as a rule can be maintained only by continuing, costly work supported by ceaseless research and improvement.

The leadership of the American Foundation for Tropical Medicine points out that United States trade with tropical countries grows impressively with each passing month despite the severe upset of labor, shipping, and other trade prerequisites in many or most major tropical areas. Though trade in many basic tropical commodities, such as natural rubber, bananas, and fiber crops, continues to show the derangement occasioned by World War II, it is today the greater part of our foreign trade.

Recent U. S. Department of Commerce records show that even during the present transition year the United States is importing all its supplies of the following commodities from tropical nations or colonies. Figures here quoted are for 1945, the latest tabulated totals. Significantly, because of irregularities and upheavals occasioned by the global war, 1945 was not a "good" year for tropical trade.

Products	Value
Coffee	$345,835,000
Cane sugar (imported) (6,573,758,000 lbs.)	?
Natural rubber (311,900,000 lbs.)	98,975,000
Crude petroleum (imported)	74,125,000
Diamonds	64,185,000
Cacao or cocoa	45,916,000
Edible nuts	39,706,000
Palm oils	34,264,000
Tea	29,497,000
Bananas	28,397,000
Molasses (industrial)	20,405,000
Rums and other spirits	19,160,000
Vegetable oils (edible)	15,948,000
Tin	9,163,000

In addition, the 1945 statistics show that the United States imported substantial or major portions of the following commodities from tropical countries:

Aluminum	$675,210,000
Copper	182,116,000
Nickel and alloy	42,814,000
Fertilizers	41,327,000
Industrial chemicals	37,894,000
Cotton manufactures	33,649,000
Vegetables	31,685,000
Lead	25,516,000
Cotton cloth	22,854,000
Plywoods	21,016,000
Leather manufactures	17,916,000

Current United States exports to tropical countries show the following major items: meat products and lard; industrial machinery (including machinery for mining, generating electric power, construction, and metal working); motor fuels and lubricants; iron and steel "semimanufactures;" autos and trucks; tobaccos; lumber; auto tires and other rubber manufactures; cotton goods; woolens; steel mill manufactures, electrical machinery and apparatus; radios; medical and pharmaceutical preparations; soaps and toilet goods; scientific and professional instruments; dairy products (other than fresh milk); dehydrated foods; coal-tar products; books, maps, and other printed matter.

Department of Commerce statistics indicate that at present more than half of all the foreign trade of the United States is with tropical areas, with exports of manufactures and imports of necessary raw materials predominant.

Official tabulation completed through 1945 shows that during that year of transition from war to peace the United States exported about 4.122 billion dollars' worth of goods to tropical countries or colonies and imported about 3.54 billion dollars from them, both totals exclusive of military supplies. During the same year the grand total of all United States exports and imports was slightly less than 14 billion dollars.

Significantly, United States trade with tropical lands has more than doubled since 1936 and is clearly headed upward. On a per capita basis our present exports to tropical areas are believed to total about $50 a year for every inhabitant of the United States. Despite unsettled world conditions the trade balances remain generally favorable to the United States.

For example, during 1945 our exports to Africa totaled $523,761,000 against imports of $295,859,000; our exports to Oceania and lower Asia totaled $1,199,000 against $576,271,000 in imports. During the same year United States exports of $645,491,000 to South America were overbalanced by imports of $962,428,000.

The most recent approved resume of United States trade with the tropics shows the following totals in thousands of dollars as of 1945, except as otherwise noted:

Country	Exports to the United States	Imports
Mexico	$1,262,928	$1,623,264
India and dependencies	491,251	173,157
Cuba	308,683	230,620
Brazil	215,617	311,250
Australia	310,649	125,981
Hawaii	240,815	87,460
Puerto Rico	160,969	144,675
Union of South Africa	131,120	103,830
Venezuela	136,720	86,665
Colombia	88,299	102,847
Egypt	164,810	11,234
Ceylon	86,096	67,013
Uruguay	48,606	66,145
Curaçao, N. W. I.	30,820	64,670
Algeria	91,544	2,022
Peru	42,521	33,591
New Zealand	37,303	33,738
Belgian Congo	17,787	48,657
Kenya-Uganda (1944)	27,200	22,500
Iran (Persia)	$28,106	$17,318
Bolivia	14,275	27,902
Guatemala	14,679	24,267
Panama	33,721	2,613
Dominican Republic	18,777	14,460
Ecuador	15,230	14,005
Costa Rica	16,023	10,916
Haiti	9,611	15,949
Iraq	10,960	10,461
Southern Rhodesia (Africa) (1944)	9,300	11,600
Honduras	10,262	9,020
Netherlands Indies	20,951	2,015
El Salvador	8,672	6,970
British Gold Coast (1944)	7,300	8,600
Nicaragua	8,531	5,024
Tanganyika	7,000	5,600
Paraguay	2,562	6,221
Virgin Islands	4,575	4,117
British Malaya	1,045	5,724
French Morocco (1944)	2,665	3,609
French West Africa (1944)	1,726	2,077
Mozambique (Africa) (1944)	1,627	1,813
Indo-China (1944)	865	650

On the basis of these statistics, and other reliable proof of the steadily growing importance of tropical trade, the American Foundation for Tropical Medicine seeks the support of business as well as science in perpetuating the international research center for tropical medicine. On the grounds that good health is a first essential to good business and secure lives, the Foundation submits that interdependence between the United States and the tropics is more vital than ever before in this age when living conditions abroad have become an essential factor of our lives at home.

PROGRESS IN THE TRANSFORMATION OF ENERGY*

By P. C. KEITH

Mr. Keith, as President of Hydrocarbon Research, Inc., is putting the final touches on a process for the conversion of natural gas to 90-octane gasoline. During the war he was a member of the Planning Board, S-1 Section, O.S.R.D., forerunner of the Manhattan District. Later, as Vice-president and Technical Director of the Kellex Corporation, he was responsible for all research and development, process design, engineering, procurement of materials, and supervision of plant construction for the Oak Ridge gas diffusion project.

BECAUSE so much has been written concerning our dwindling oil reserves by the National Resources Planning Board, the Department of the Interior, the O'Mahoney Committee, and members of the oil industry, most Americans are acutely conscious of what they believe to be an impending oil shortage. There seems to be a general feeling that this country must import additional supplies of petroleum to maintain and expand our present "internal combustion engine economy." Although there may be many reasons favoring the importation of petroleum, such importation is not necessary for our national security; and in the foreseeable future it might be undesirable both for security and economic reasons.

In the past two decades enormous strides have been made in the production of synthetic fuels from both coal and gas. In 1910 Bergius announced his high-pressure process. In 1927 I. G. Farben built at Leuna the first commercial plant. In the late twenties Franz Fischer announced the low-pressure Fischer-Tropsch process. In 1934 Ruhr-Chemie installed the first commercial plant at Oberhausen. Beginning in 1939 the mechanized German army, fueled primarily by the 100,000 barrels per day of synthetic oil produced from coal by these two processes, fought and nearly won a war.

* From a paper presented at a symposium on "Progress in the Transformation of Energy" at the Princeton University Bicentennial Conference on Engineering and Human Affairs, October 2–4, 1946.

It is certainly true that the cost of these synthetic oils was much higher than the cost of those produced from petroleum. On the other hand, in the light of present-day American engineering knowledge, the processes used were clumsy and unnecessarily expensive.

The production of oil from natural gas is closely akin to the production of oil from coal. Recently two companies, Carthage Hydrocol, Inc. (a company composed of various units within the oil industry), and the Standard Oil Company of Indiana, have announced plans for building two large commercial synthetic oil plants, utilizing dry natural gas as the feed stock. Both these companies expect that the cost of the motor fuel produced will be at least competitive with the cost of motor fuel produced from crude oil. The prediction has been made that the cost of motor fuel from one of these plants will be 5.25 cents per gallon. Capital charges represent about 50 percent, and raw materials about 20 percent, of this cost. When these plants have a successful performance record behind them, thus allowing a reduction in the capital charges of future plants, the raw-material cost could double or treble and the cost of fuel made would still be competitive with the cost of fuel made from crude oil.

Mr. H. C. Weiss, President of the Humble Oil and Refining Co., has announced in the press that his company is considering the installation of a gas synthesis plant. This process can convert our gas reserves into an amount of oil equivalent to our known

reserves. The possibility of quickly and economically doubling our oil supplies should be given great weight in predicting future national economy. In discussing the "over-all significance of the process,"

Mr. Weiss placed particular emphasis upon natural gas because of the importance of the future oil supply of the United States being at home or near home to insure national security in emergencies as well as the assurance of adequate peacetime supplies. Middle East oil, he suggested, would be too far out on the supply lines to be of use in the lightning war of the future.

The engineering knowledge responsible for this advance in the synthesis of oil was acquired in America during the war. Two new techniques were outstanding: the use of the "fluid bed" and the production of cheap chemical oxygen. Both these techniques can be applied to the synthesis of oil from coal. Before the O'Mahoney Committee in 1943, testimony was presented which showed that oil could be made from coal, using the high-pressure hydrogenation process, at a cost of from 16 to 18 cents per gallon—a cost so high as to be of no immediate interest to our oil industry. Recently a major oil company, familiar with hydrogenation, has privately informed me that it now believes that with a "mine-mouth" coal cost of $2.50 per ton motor fuel could be produced for between 7 and 10 cents per gallon, all costs in. My own figures indicate a possible cost of 6.5 cents per gallon, all costs in, with coal at the mine mouth worth $2.00 per ton. This latter figure is competitive with the cost of motor fuel produced from present-day crude oil. When this coal-to-oil development has been brought to a successful conclusion—and I use the word "when" rather than "if"—an important milestone in the transformation of energy will have been passed. The gas-to-oil conversion process has already materially increased our potential oil supplies, but the coal-to-oil process will cause us to reckon our future supplies by the hundreds of years rather than by decades. At that time the cry of "our dwindling oil reserves" will be heard no more. A large segment of the oil industry already believes that the economic equivalence of gas to oil has been proved, and that the economic equivalence of coal to oil will be proved in a few years. I believe that present technological developments ensure that in the future we shall have a cheap and abundant domestic supply of oil for use in aircraft, automobiles, locomotives, house-heating systems, etc.

Concurrent with advances made in the synthesis of oil from coal and gas, there have been extremely important advances made in the conversion of coal into gas. The Lurgi Company, of Germany, in 1936 placed in operation at Zittau their first high-pressure coal gasification plant to produce directly from coal (i.e., without using any oil gas for enrichment), a gas suitable for town use. The process is simplicity itself. By means of a lock-hopper system, brown coal is fed semi-continuously into the top of an open vessel, suitably insulated, and maintained at a pressure of about 300 pounds per square inch. Into the bottom of the vessel is fed a mixture of steam and oxygen. By incomplete combustion the coal is gasified (some oil being recovered as a by-product), the ash being withdrawn semicontinuously from the bottom. Technically, the process has been a great success. At Zittau the gas made has a calorific value of about 470 B.T.U. per cubic foot when freed of its carbon-dioxide content. Not long ago, at Most, Czechoslovakia, I had the privilege of inspecting in detail the last Lurgi installation built. Gasifying brown coal, sized 4–10 mm., they were producing a finished town gas having a calorific value of 570 B.T.U. per cubic foot. Had the oil distilled from the coal been returned to the generator for cracking, the calorific value of the gas made would have been in excess of 600 B.T.U. per cubic foot. The efficiency of the gasification step was in excess of 80 percent.

This installation was supplying gas, at

300 pounds pressure, to a 120-mile gas distribution system. A pipe line from Prague to Most is under construction, which will add another 70 miles to the distribution system. At present the Lurgi generation plant is being doubled in capacity. With the removal of some obvious bottlenecks, this installation could produce 15,000,000 cubic feet of town gas per day directly from low-grade coal, with a thermal efficiency of plus 80 percent.

As American engineering improved and cheapened the synthetic oil processes, so it can materially improve and cheapen the coal gasification process. Whereas the present Lurgi process utilizes a highly reactive, noncaking brown coal, there is no basic or fundamental reason why a high-caking, relatively inactive, bituminous coal cannot be gasified to yield a gas of 900–950 B.T.U. per cubic foot, with a thermal efficiency of plus 80 percent. Development work to achieve this is already underway. The first indications are that it will be successful. The economic equivalence of brown coal to town gas (gas with about 535 B.T.U. per cubic foot) having been demonstrated, the economic equivalence of bituminous coal to town gas and pipe-line gas should be shown within the next few years. Incidentally, our coal reserves are in excess of 3 trillion tons—enough for 2,000 years at present consumption rates. Converted to gas, this is equivalent to about 60,000 trillion cu. ft.—enough to last at the present rate of gas consumption approximately 1,500 years.

Dr. Alexander G. Christie has said, "Rising costs of natural gas and fuel oil assure the predominating position of coal as our leading reliance for energy production." To this statement I should like to add the thought that the extent to which oil and gas costs rise will be strictly limited by the widespread emergence of coal-to-gas and coal-to-oil processes. The economic equivalence of one to the other has already been partially shown. The demonstrable complete equivalence is but a few years hence.

So MUCH for the present "state of the art" in the transformation field. Oil made in Texas must be used elsewhere. Gas, if made from coal in West Virginia, will be used in more highly industrialized areas. The cost of transporting oil or gas has steadily decreased within the past decade.

The cost of transporting coal has not shown a corresponding decrease. In my opinion, the railroads are not wholly to blame for this lack of improvement. Beset as they are with rate-regulatory bodies on the one hand and rather inflexible labor policies on the other, they cannot quickly adjust themselves to maintain a competitive position with the ever-evolving and newer means of transportation. In the foreseeable future this inability to adjust themselves may react to their detriment.

The transportation of oil is an example. In 1939 the Class I railroad average rate, expressed in cents per barrel per 100 miles of straight-line distance, was 19.78 cents; a comparable rate for pipe lines was 3.92 cents per barrel. The rail rate was some five times larger than the pipe-line rate. During the war the operation of the Big Inch and the Little Big Inch showed what can happen to pipe-line costs when pipe diameters are increased, pumping equipment is made efficient and largely automatic, and load factor is kept high. A cost for the Big Inch comparable to the ones already given is 1.34 cents per barrel—about one-thirteenth of the rail rate. True it is that a comparison today of the Big Inch rate with the rail rate is largely academic—but in 10 or 20 years it may not be academic, and the trend has been shown. During the war we added 8,000 miles to our oil transportation system, of which 5,000 miles were product lines—lines largely in direct competition with the railroads.

Although I do not have specific and precise figures to show the decreasing cost

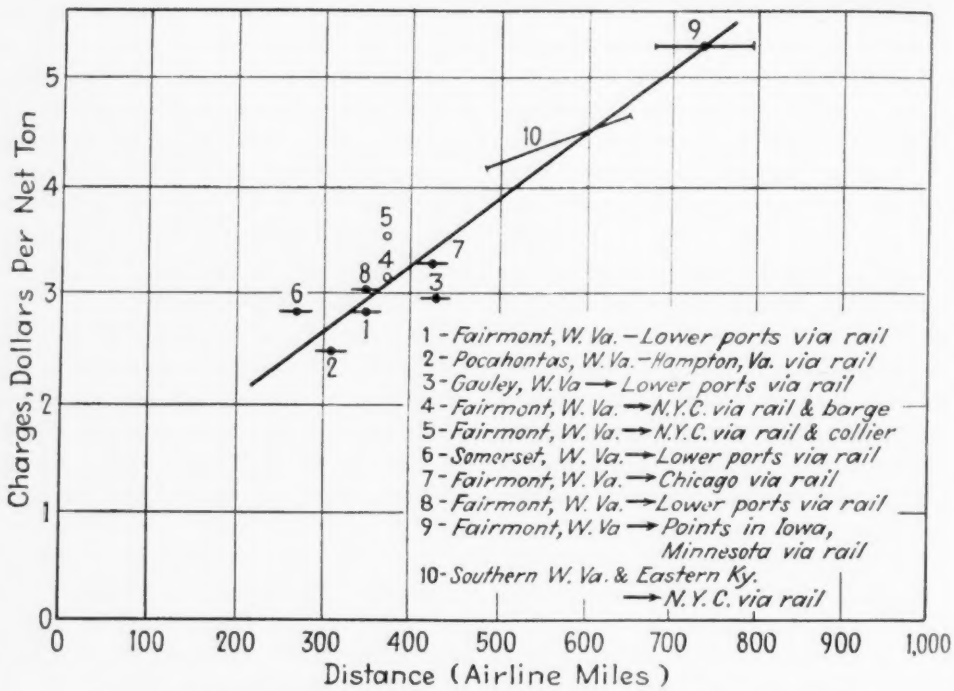

Charges, Dollars Per Net Ton
Distance (Airline Miles)
0
100
200
300
400
500
600
700
800
900
1,000
1
2
3
4
5
6
7
8
9
10
1 - Fairmont, W. Va. — Lower ports via rail
2 - Pocahontas, W. Va. — Hampton, Va. via rail
3 - Gauley, W. Va → Lower ports via rail
4 - Fairmont, W. Va. → N.Y.C. via rail & barge
5 - Fairmont, W. Va. → N.Y.C. via rail & collier
6 - Somerset, W. Va. → Lower ports via rail
7 - Fairmont, W. Va. → Chicago via rail
8 - Fairmont, W. Va. → Lower ports via rail
9 - Fairmont, W. Va → Points in Iowa, Minnesota via rail
10 - Southern W. Va. & Eastern Ky. → N.Y.C. via rail

FIG. 1. SOME TYPICAL COSTS OF TRANSPORTING COAL BY RAIL

of transporting natural gas when larger-diameter lines and higher pressures are used, I am certain that postwar long-range gas transmission costs will be distinctly less than the prewar costs that were applicable to smaller-diameter, lower-pressure lines. A large-diameter gas line is now being laid from Texas to California, and there is much agitation to convert both the Big Inch and the Little Big Inch to gas service. The private capital responsible for the California line is sure the piping of gas long distances is a cheap way of transporting energy. Bidders for the Big Inch and the Little Big Inch were convinced that the use of these lines to transport energy from Texas to New York would be economic.

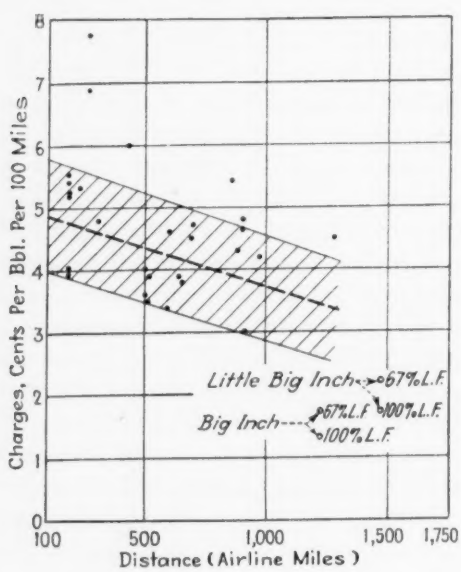


FIG. 2. OIL VIA PIPE LINE

COST OF TRANSPORTING OIL BY PIPE LINE.

If, then, in the future our main reliance for energy is upon coal, and if coal can be economically transformed into gas and oil, it will be interesting to compare the cost of transporting energy as coal to that of transporting an equivalent amount of energy as gas and oil.

Figure 1 shows some typical costs of transporting coal by rail and by rail and water. As a specific example, the average

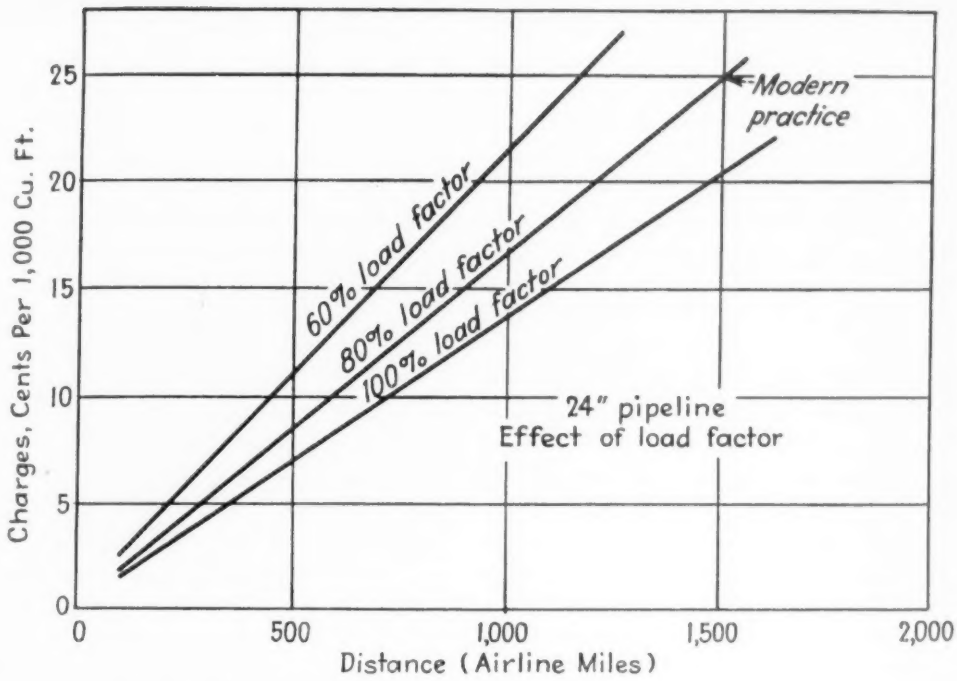


FIG. 3. COST OF TRANSPORTING NATURAL GAS BY PIPE LINE

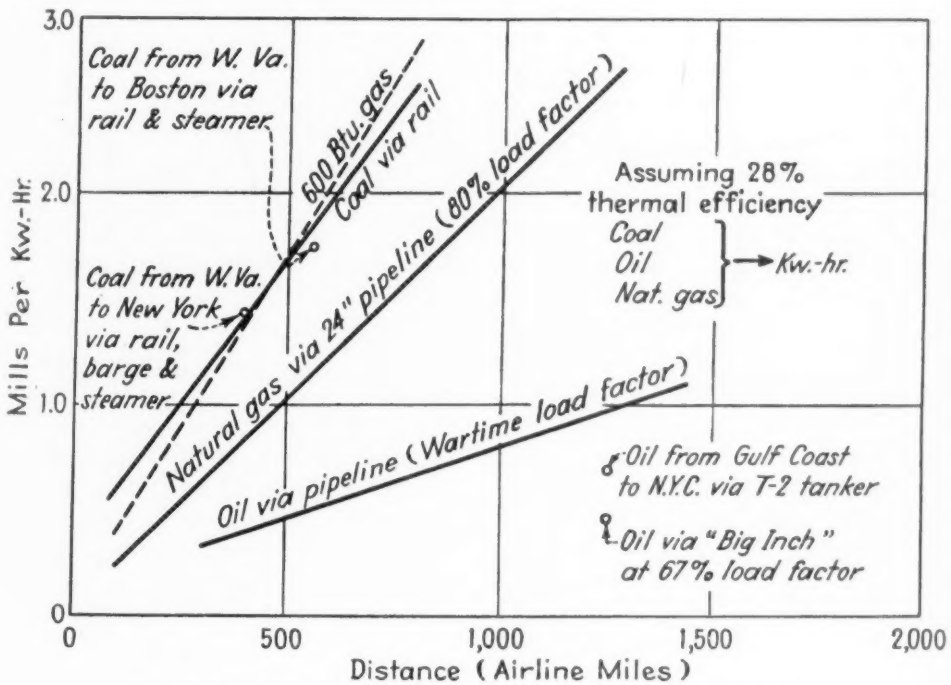


FIG. 4. RELATIVE COST OF TRANSPORTING VARIOUS FUELS

costs of transporting a ton of coal from West Virginia to New York City by rail and water is $3.35 per ton—a figure in excess of the mine-mouth production cost of the coal.

Figure 2 shows an attempt to average pre-war pipe-line transportation costs. Take, for example, the cost for the Big Inch. Either at 100 percent or 67 percent load factor, the experienced costs were much lower than the average. On the assumption that a barrel of fuel oil contains 6,000,000 B.T.U., one may reckon that transporting the equivalent of one ton of coal from West Virginia to New York will cost 73 cents, a differential between the coal cost and the oil cost of $2.62 per ton. In other words, transporting energy as coal in this particular case costs three and one-half times as much as transporting the same energy as oil.

Figure 3 shows the cost of transmitting energy in the form of gas. For our particular case, that is, transporting 29,000,000 B.T.U. from West Virginia to New York (and in the subsequent discussion a 14,500-B.T.U. per pound coal has been assumed), the transportation cost for gas would be $1.92 versus $3.35. Again there is an incentive for the engineer to develop a process for cheaply gasifying coal and transporting this energy as gas.

Figure 4 compares transportation costs of the various fuels on a mills per kw-h basis. Since the production of 600-B.T.U. gas is already an established fact, I have shown a curve for the transmission cost of 600-B.T.U. gas (at 80 percent load factor) from West Virginia to New York. Transportation of this calorific value gas is about a standoff with the transportation of coal, assuming no differential advantage in the use of the gaseous fuel.

Either gas or oil is a more efficient fuel than coal, however. While very large high-pressure, high-temperature steam stations may achieve a thermal efficiency of 31 percent, a better average figure would be 28 percent. On the other hand, either Diesels or high-M.E.P. gas engines can, even in small sizes, achieve an efficiency of 34 percent. (Incidentally, the widespread, cheap distribution of gas and oil, coupled with the assurance that they would be readily available in the future, would be a great aid in the decentralization of industry.)

As I have said, there is every reason to believe that coal may be gasified into high-B.T.U. gas with a thermal efficiency of about 80 percent. Predicted operating cost for such an installation, exclusive of all fuel charges, is about $1.00 per ton. From the figures given here, one may reckon that when gaseous B.T.U.'s compete on an equal basis with coal B.T.U.'s, with coal worth $2.50 per ton in West Virginia, the transportation of a 900-B.T.U. gas begins to look attractive. If allowance be made for the superiority of gaseous fuel when compared to solid fuel, the transportation of 700-B.T.U. gas looks attractive. Certain it is that if the American engineer achieves his ambition of producing 1,000-B.T.U. gas from coal, at an efficiency of 80 percent, then the transportation of coal as gas will become a reality.

The figures for transporting coal as oil do not as yet look attractive. Even if coal were $1.00 per ton and allowance made for oil's superiority, the figures are disappointing. Again excluding fuel cost, the present predicted costs of transforming a high-B.T.U., low-moisture, low-ash coal into oil are over $5.00 per ton, or about $1.93 per barrel. Until the capital and operating costs of converting coal to oil can be decreased, there need be no fear of competition from oil made from coal. However, gasoline made from coal will in the near future compete with gasoline made from crude oil.

In conclusion, there is no impending oil shortage, there is impending competition between gas made from coal and natural gas, and there is impending competition between coal moved as gas and coal moved as coal.

TRENDS OF VOCATIONAL ACHIEVEMENT IN MENTAL DISORDER*

By ALBERT I. RABIN

Dr. Rabin (Ph.D., Boston, 1939) was born in Lithuania and came to this country at an early age. He has had numerous opportunities for investigations in abnormal and clinical psychology during his eight years as Chief Psychologist, New Hampshire State Hospital, Concord. He is President of the New Hampshire Conference for Social Welfare. Dr. Rabin devotes his spare time to tennis, swimming, and mountain climbing in the summer and to skiing in the beautiful White Mountains in the winter.

THE present study is an outgrowth of a more extensive investigation regarding patterns of mental functioning in psychiatric disorders. One thousand consecutive admissions to the New Hampshire State Hospital constitute the experimental population. These patients represent twenty-one psychiatric categories, including the major psychoses and neuroses, as well as some other minor disorders. With few exceptions the entire group is made up of adults under the age of sixty and is evenly divided into males and females. Educationally, since this group was selected at random, it corresponds very closely to the educational level of the general population as reported in the 1940 U. S. Census. Not only is there agreement as to the average grade achieved, but there is close agreement in the percentage of educational achievements at each of the several levels, that is, similar percentages of college graduates, high-school graduates, etc.

Disregarding possible fortuitous constellations of circumstances as well as the more specific economic factors, the level of vocational achievement is frequently a key to the individual's effective intellectual functioning. It is not only an indicator of the individual's intellect or capacity, but is symbolic of his "manifest intelligence" or effective wisdom in obtaining the more valued occupational status in our competitive culture. For this reason, the occupational levels of individuals suffering from various and sundry mental disorders become of interest to the investigator in this little-exploited field. Data obtained from such investigations may throw some light on one of the many moot questions in the field of psychopathology, namely: Is mental disorder a sudden attack upon the integration of personality, without premonition, or is it a slow, prolonged, and insidious process, which comes suddenly to a climax, but shows its effects, indirectly, through the life history and achievement *niveau* of the patient-to-be?

The case histories of the thousand patients were carefully checked, and the highest occupations achieved prior to hospitalization were recorded. In 61 cases no occupations were reported, since the patients were so young that they had no occupational opportunities prior to hospitalization. Also, 123 of the female patients were housewives with no other occupation prior to marriage. Thus, the final results concerning the patients' occupations were based on 816 cases; i.e., the total sample of 1,000 minus the 184 belonging in the above-mentioned categories. Classification of the 816 recorded occupations was especially facilitated by the recently published supplements of the *Dictionary of Occupational Titles*, in which thousands of occupations are coded and classified. The following are the major occupational classificatory categories, with their code numbers preceding them:

* Some of these findings were reported at the Boston meeting of the A.A.A.S., December 1946.

FIG. 1. A COMPARISON ACCORDING TO OCCUPATIONAL CATEGORIES

THE PERCENTAGES OF THE PATIENT GROUP IN EACH OCCUPATIONAL CLASS ARE COMPARED WITH THE CORRESPONDING PERCENTAGES OF GAINFULLY EMPLOYED ADULTS IN NEW HAMPSHIRE (1940 U. S. CENSUS).

0—Professional and managerial occupations
1—Sales and clerical occupations
2—Service occupations
3—Farm occupations
4-5—Skilled occupations
6-7—Semiskilled occupations
8-9—Unskilled occupations

An over-all view of the occupational status of the patient sample may be obtained from Figure 1. In this diagram the percentages of the patient group in each occupational class are compared with the corresponding percentages of gainfully employed adults in the state of New Hampshire (1940 U. S. Census). The last two occupational categories of semiskilled and unskilled occupations were combined, since the obtained data were insufficiently accurate to differentiate between them.

Upon examining the diagram our attention should especially be focused on the two points of maximum contrast. The first occupational category shows a most marked difference between the patient group (solid bar) and the state population as a whole (striped bar). The percentage of patients reaching professional and managerial status is only one-half of normal expectancy. On the other hand, the percentage of patients engaged in service occupations is almost twice the expectancy in the general population. The differences in the other categories are minor and not so clear-cut. Practically no differences are observed in the last, combined, category of the semi- and unskilled occupations.

A generalization that may be tentatively suggested on the basis of these results is that the patients show markedly lower representation in the occupations requiring higher intelligence, persistent effort and efficiency in competitive achievement, despite an educational level equal to that of

the general population. The data also suggest the tendency of the patient population to gravitate, possibly compensatorily, toward occupations requiring comparatively little skill, intellectual exertion, or arduous preparation. Thus, the general conclusion, in answer to the problem posited earlier, is that the process of mental disorder is apparently long and insidious and manifests itself much earlier than is ordinarily suspected in the afflicted individual's adjustment to his competitive society.

As was noted above, our sample was drawn from a psychiatrically heterogeneous group in which twenty-one nosological classes were represented. In view, therefore, of the findings concerning the occupational status of the patient sample, the question as to whether *all* psychiatric categories are equally responsible for the comparatively low occupational level becomes quite pertinent. If not all the disorders show a similar trend, which are the ones that are most effective in preventing the patient's achievement in the vocational field? The accompanying diagram gives at least a partial answer to this question.

Psychoneurosis, manic-depressive psychosis, and schizophrenia are three major psychiatric categories that constitute more than 50 percent of our total investigated population. The occupational levels of these three groups are compared in Figure 2. Most obvious, in the professional and managerial category, is the comparatively high percentage of neurotics and the extremely low percentage of schizophrenics, with manic depressives occupying a middle position. Almost twice the percentage of psychoneurotics is found in the professional

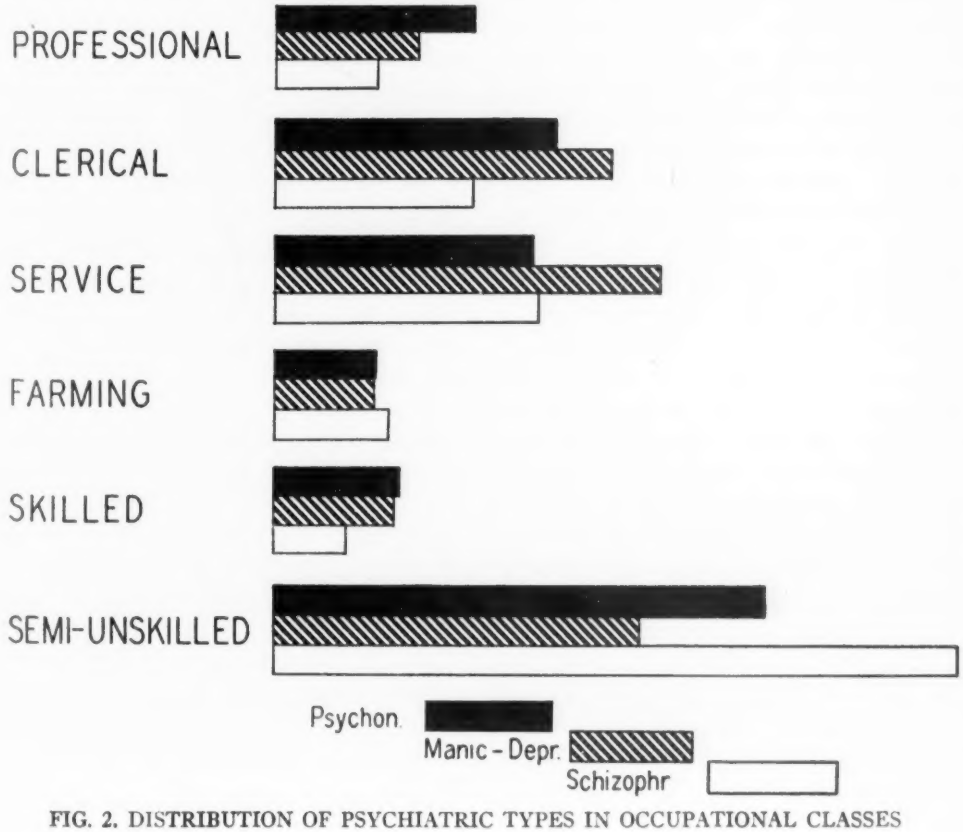


FIG. 2. DISTRIBUTION OF PSYCHIATRIC TYPES IN OCCUPATIONAL CLASSES

category when compared with the percentage of schizophrenic patients. This fact is especially striking, since the average educational achievement of the psychoneurotic is below that of the schizophrenic, the average grade completed in the former group being around 8.5 and in the latter, 9.5. Fewer significant intergroup differences are to be noted in the service and clerical (classes 1 and 2) occupational categories. A dominant manic-depressive trend is noted in these two categories, with psychoneurosis and schizophrenia falling fairly closely behind. All three disorders are almost exactly alike in the extent of their representation in the farming category. The percentages in the skilled occupations again reveal the comparative inferiority of the schizophrenic group. The percentage of psychoneurotics and manic depressives is almost twice that of the schizophrenics in the skilled-occupations category. Finally, the combined semi- and unskilled occupational classification shows up some further marked differences. Nearly one-half of all our schizophrenics are semiskilled or unskilled workers; about one-third of the psychoneurotics fall in this category, whereas only one-fourth of all our manic depressives are so classified. These percentages are especially interesting in view of their relationship to the educational level achieved by the respective groups. The manic-depressive group, with the lowest educational achievement (mean grade completed, 7.4) has the smallest percentage in the lowest occupational category, whereas the schizophrenics with the highest average educational attainment have the greatest representation in the lowest category.

When the data discussed above are taken into consideration, it quite clearly appears that in types of occupation requiring continuous effort and training, in the professions, management, and skilled occupations, the schizophrenic group lags markedly behind the two other major groups of psychoneurosis and manic-depressive psychosis. The difference in percentages at the higher occupational levels is made up by the schizophrenics by joining the ranks of the semi- and unskilled workers. The indications are, also, that the manic-depressive group, despite comparatively inferior education, is well represented in the more desirable occupations of our culture and less in the more undesirable ones, than are the schizophrenics. The psychoneurotics, with the exception of a large percentage in the professional category, present equivocal results.

In conclusion, an attempt to answer the second question raised may be made. Not all psychiatric nosological categories are equally responsible for lowering the occupational status of the total sample of the 816 patients studied. Schizophrenia is the one disorder, importantly represented in our population, that is chiefly responsible for the comparatively low occupational level of the entire patient group. In schizophrenia, the onset of the disorder is gradual, even prior to its overt manifestations, thus preventing early occupational adjustment commensurate with the individual's capacities and educational background and opportunities.

As a corollary of this conclusion, the question of the desirability of early spotting, by clinical personnel, of those individuals in whom is found the discrepancy between ability and educational achievement, on the one hand, and occupational status on the other, may be raised. Such a procedure may focus early attention to those individuals and should be one of the indications of a need for therapeutic measures.

PROBLEMS IN MAP EDITING*

By EDWARD B. ESPENSHADE, JR.

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WORLD WAR I was fought over a relatively limited area, and the more intense action was over an even more restricted area. Action was largely stationary, as indicated by the name "trench warfare," and took place for the most part in well-mapped areas. The demand for maps, therefore, was limited, both in areas to be covered and in quantity, since as a rule only officers needed maps. The French mapping agency, the Service Géographique d'Armée, with some help from the British agency, the Geographic Section, General Staff, was able to supply these needs easily, largely from existing plates based on ground surveys. The United States Army had relatively little or nothing to do with map production.

The recent global war was in striking contrast. The airplane made complete coverage of the earth necessary on not one, but several scales. Ground operations on numerous fronts in widely separated areas required larger-scale maps, not just for parts of countries, but for part or all of several continents. The mobile nature of warfare made maps a necessity for enlisted men as well as officers. In both cases maps had to be prepared covering large areas for which basic surveys were lacking and for which information was scanty. Whereas the same sheet may have sufficed for several months in World War I, in World War II a soldier might have covered in a single day the area shown on several sheets at some scales. The result is that probably more maps were published in some months during World War II than during the whole of World War I. An operation like that in North Africa might require 15,000,000 maps, and annual production in this country alone might approximate 50,000,000 copies, involving from 5,000 to 10,000 different sheets. The enormous task of preparing military maps for field operations in World War II was assigned to the Geographic Section, General Staff, British War Office, including the Survey Directorates of the Commonwealth and Colonial governments, and to the Army Map Service, Corps of Engineers, U. S. Army, in this country. By agreement between the two agencies, the world was divided into areas of responsibility for map production.

Scope of types of maps. What were the types of maps required for military field operations? They fell into four broad groups: aeronautical charts, planning maps, maps for mechanized operations, and maps for infantry and artillery operations.

Aeronautical charts were the responsibility of the Army Air Forces, although the Army Map Service provided coverage for compilation and acted as printing contractor for them. These charts were for the most part on small and medium scales, but were planned for extensive coverage over the earth's surface. They included charts at scales of 1:5,000,000, 1:3,000,000, 1:1,000,000, and 1:250,000; for bombing-target charts, the scale might be as large as 1:75,000.

* From a paper read before the Washington Geographers' Club.

Most planning maps were on small scales, from 1:1,000,000 to 1:10,000,000. They included theater area and regional planning maps, strategic maps (usually over individual countries), communication maps for logistic planning, and such general series as maps belonging to the International Map of the World framework.

Maps for mechanized operations were usually on a medium scale, from 1:150,000 to 1:500,000. They were of a relatively general nature, with emphasis on roads.

Maps for infantry and artillery operations were on large scales, from 1:20,000 to 1:125,000. They were the common topographic map expressing surface configuration, cover, and cultural features in considerable detail. Large-scale city maps might also be considered in this group.

Methods of map production. Maps can be produced to provide the various needs just mentioned in any one of four ways or in various combinations of them.

1. They may be a reproduction of a ground survey; for example, a U.S.G.S. Quadrangle.
2. They may be a reproduction of a survey from air photographs; aerial mosaics might be included here along with maps drafted by trimetragon, multiplex, and other air-survey methods.
3. They may be the product of redrafting or mechanical facsimile reproduction in one or more colors of a previously published map.
4. They may be the result of compilation from several series of maps, possibly unrelated, and other source material.

Circumstances will decide which of the above methods or combination of them may best be used. The decision is determined generally by the information the map is to show, the source material available, the scale at which it is to be reproduced, and the time available for completion of the map. The last two methods were used for the greater number of the maps produced in World War II. Redrafting or mechanical facsimile reproduction is nothing more than copying an existing map, with possible revision and translation of border information and addition of the military grid. It is a method to be used when time is extremely short, and it is a procedure requiring a minimum amount of effort. The results are not always completely satisfactory: the date of the original map may be old, and the nature and appearance of the copy may give a reproduction not easily readable.

The last method, "compilation for an area," is the most difficult. It has been described as a "science" and as an "art;" it requires some of each. It involves evaluation of the accuracy and usefulness of all available source material; interpretation of the material and decisions concerning methods of using it; and incorporation of this source material into a unified map at the desired scale.

The editing problems discussed here are concerned primarily with compiled maps. Many of the compilation problems were the result of three factors: mass-production methods, necessitating the use of relatively untrained personnel; lack of knowledge of foreign maps; and lack of familiarity with the areas covered. The 1:1,000,000 map of South America, compiled by the American Geographical Society, is the only extensive foreign compilation job undertaken by an American agency, with the exception of the nautical charts of the U. S. Hydrographic Office and the Coast and Geodetic Survey. Done over a comparatively long period of years, it was possible to use highly trained personnel for direct supervision and even to check material in the field or with local authorities. In contrast, under war conditions the quality and nature of the map could be controlled only indirectly by preparation of specifications and instructions as detailed in nature as possible, and by relatively rapid inspections of the work at critical stages by competent, experienced personnel.

Source material problems. When a map is

to be compiled, the first step is the collection of source material, including maps and pertinent reports over the area. The nature of the source material selected depends, of course, on the type and scale of the map to be prepared; it may include all or only some of the following main types of materials:

1. Ground surveys, including completed or uncompleted field sheets of an area, town plans, and lists of geographical coordinates of various points, fixed by primary, secondary, or tertiary triangulation.
2. Air photographs, including systematically exposed strips of verticals, single photos or pairs of photos, and obliques.
3. General maps, including the following: (*a*) large-scale maps giving a representation of all physical features, both natural and cultural, which by their nature are usually based on ground or air surveys; (*b*) medium-scale maps, which give a conventionalized picture of a country and show all features that can be legibly drawn at the scale used; (*c*) small-scale maps used normally to give a broad picture of an area, on which features are generalized and information is often incomplete, but which help to show the various relations between features—for example, the relative importance of towns and major relief structures.
4. Charts, of various scales, which are useful primarily because of their detailed treatment of coastal features.
5. Communication maps, consisting of medium- and small-scale road and railroad maps. They may show details of the surrounding country or they may be diagrammatic. Road guides, timetables, and similar items may be included here.
6. Explorers' route maps; these may vary considerably from rough compass traverses, with brief notes, to detailed descriptions of routes, accompanied by aneroid readings and calculations of geographical positions by astronomical observations.
7. Descriptive material, including such diverse material as tourist guidebooks, textbooks, geographical articles from magazines, newspaper accounts, and military intelligence reports and summaries.

The collection of the source material in connection with a particular compilation job may require considerable effort and ingenuity; the task of analyzing and evaluating it requires qualities of scientific integrity and judgment. It is the most fundamental problem in editing a map. The result is an estimate of the relative accuracy and utility of each piece of material. In a simple compilation it is a mental process; in more complicated work it should be written. In either case it should systematically follow definite steps: the listing and appraisal of the material; comparison of the material; and a decision concerning its use. Let us examine each of these steps.

Listing and appraisal of the source material involves (*a*) drawing an index diagram in colors and showing in a generalized way the area covered by each source item; (*b*) listing information concerning the title, scale, publisher, date, and detail shown; and (*c*) preparing a statement of the reliability of each item. An accurate estimate of the reliability of any map or map series involves the analysis of many factors and sometimes can be ascertained only by careful and thorough research. If it is necessary to limit oneself to that information appearing on the face of the map, which is often the case, one is handicapped in an appraisal. Certain broad principles can be used, however, in an examination of the map on the basis of four factors: the authority, date, scale, and appearance of the map.

The authority is an excellent index to the reliability of a map. Established government agencies that are known to be in the business of making maps may generally be accepted as competent and reliable. A government agency responsible for a basic field-mapping program in a country is apt to be more reliable than agencies whose mapping is incidental to other activities. On the other hand, if a particular type of areal information is desired, such as roads, maps published by an agency responsible for road material are apt to be more accurate for that particular feature. At the same time, such "special-

purpose" maps may be unreliable for other features. For example, a map published by a department of roads may not be reliable for railroad information. It is a mistake, however, to assume that because a map is published by a government agency it is reliable. This is particularly true in the case of countries relatively backward in cartographic development and especially when basic field surveys have not been made in the area in question. A German map for a section of China published by the Reichsamt fur Landesaufnahme is apt to be more accurate than topographic maps made from reconnaissance surveys by the Chinese Government. Similarly, maps prepared in connection with flood and irrigation problems in North China by American engineering companies should be considered more reliable than official Chinese topographic maps.

It is somewhat more difficult to make generalizations concerning privately published maps. In the case of maps resulting from scientific expeditions, the reliability of the work can sometimes be ascertained from descriptive notes published with the maps. There are considerable differences in the accuracy, however, of many route traverses, and care is not always taken to report survey methods. For example, material published by Filchner in connection with his expedition into Central Asia, to make magnetic observations, appears to be much more reliable (probably because of the purpose of the surveys) than that of Roy Chapman Andrews, of the American Museum of Natural History. Privately published maps by commercial companies are subject to considerable variation. A few companies have world-wide reputations; others, such as Bartholemew, Michelin, and Jih Sin, have national reputations, which can be used as an index to selection of material. In some cases the reliability can be credited to a single man; for instance, V. K. Ting, in China, and Fujita, in Japan. It is apparent, then, that there is no unqualified generalization that is infallible, but by experience one can gradually develop ability to estimate the reliability of a map from a knowledge of authorities.

Dates are a second index to the value of a map and one which at first glance would seem to be a relatively simple one. On the contrary, they offer many difficult problems. They are particularly important because of the emphasis in military maps of having material as recent as possible. Unfortunately, many maps do not carry dates. This is especially true of those made by private publishers. They feel it may prevent sales; with the exception of such general items as road maps, I think this is a mistaken viewpoint. Many publishers, however, have codes from which dates may be ascertained. Some can be readily broken, others require information from the publisher. Lacking a date, one may be approximated from the time of purchase or acquisition; by comparing with another map of known date to determine, for instance, if a railway or road under construction has been completed; or by examination of the magnetic information. In some instances the style of the map may indicate its date.

Even though a map bears a date, one's difficulties may not be solved. The significance of the date may or may not be indicated. It may be the date of survey, compilation, publication, revision, reprint, or the latest edition; there may be only one date or as many as four. Further difficulty is encountered in the terminology applied to dates on foreign maps. Some twenty-four different phrases applying to dates are found on the Chinese General Staff 1:100,000 topographic maps; from one to three phrases may occur on a single map. Precise translations are difficult and often inconsistently applied. For example, the three terms "edition," "reprint," and "imprint" date, in English and in their various foreign counterparts, carry different implications, depend-

ing on the policy of the publishing agency. A new edition may involve major or minor changes; a reprint may involve considerable change, minor plate changes, or no difference between copies; and an imprint date may indicate minor changes that can be made on the press plate, or a new run with no differences. Of course, careful study can solve many of these problems or at least give an approximate answer. But time is often valuable, and days may be lost over a light table comparing editions of a large series of maps for emergency facsimile reproduction. A prime example is Central Europe, where several editions of a single map published by each of four countries may be available. Each map may carry from one to three dates with no indication of their significance. As a result of such problems, dated collation indexes for map series made up by different individuals located in London, Chicago, and Washington may result in the choice of the wrong sheet, since comparisons may not be possible and a common basis for dating cannot always be determined. The library of the Army Map Service has been working on a preliminary guide to dating methods for various countries, which should lead to more systematic results, if not the proper answer.

If one can solve the pure mechanics of dates, care must still be exercised in their use. If a date is that of an original survey, it is an important index to a map's accuracy. Land forms change very little within those time periods with which one deals in considering maps for military use, except along shore lines and meandering rivers. As a rule, therefore, general land forms as depicted by contours, hachures, and form lines may be accepted as being reasonably accurate regardless of the date of survey. It may be assumed, however, that prior to the extensive application of aerial photography to mapping, serious displacements of horizontal and vertical position may be encountered in extremely rugged and heavily wooded country, since such areas are difficult to delineate accurately in the normal use of ground survey methods. With respect to cultural features, the date of survey must be considered in relation to the normal expectancy of cultural change. Changes over a period of years may be minor or very extensive, depending on the rapidity of development of the region. In sparsely settled regions, maps from thirty to forty years old may be relatively accurate for cultural features. This does not hold, however, in some areas; for example, in Central Asia, where surveys may show the locations and names of nomadic settlements. By cumulative compilation, made by cartographers over many years, a map may contain many nonexistent settlements. Special symbols or the elimination of settlement locations in preference to tribal names should be used in such areas. In highly industrialized areas, extensive changes may render a map obsolete within a short time after publication. A knowledge of areas, however, often helps an individual to make further generalizations concerning the usability of features depicted on a map. In Central Europe the stabilized nature of the forest cover, owing to methods of forest farming, makes it feasible to accept forest cover from maps of relatively old dates.

Dates other than that of an original survey date are subject to considerable misconception. One assumes that when a compiler makes a map he uses the latest source material he can find, but how thorough was his search and how extensive were his facilities? Most maps fail to list the source materials used and fail to give the date of publication. These are some of the problems that result from dates on maps. Since time is an important factor, it is often necessary to accept a map as it is and to assume, if the original basis is sound, that the physical detail will not be changed greatly and that, though the patterns and populations of cities may be altered significantly, their general positions

and shapes will remain unchanged. The user of the map can be guided by a note giving the date of the original survey or publication of the map copied. Since communications are apt to be subject to considerable change and are of extreme importance in modern mechanized warfare, a fairly practical military map can be obtained by a revision only of communication features according to latest information, with a note giving the date and method by which they have been revised.

The scale at which a map is published may be helpful in indicating the accuracy of the original survey or compilation. It is normal cartographic practice to prepare original surveys and compilations at a scale somewhat larger than the final scale of reproduction. Therefore, the published scale reflects the accuracy of position and delineation of the original survey and likewise is indicative of the amount of detail which has been included or omitted. When several series of maps at different scales have been published over an area, care should be taken to note the order in which the original maps were prepared. If a first series published is at a large scale, a second series at a medium scale can usually be assumed to have been based on the first and larger series. In the case of the reverse situation, which amounts to the blow-up, or enlargement, of a series, care should be exercised. If the publisher redrafted the sheets in the process it is sometimes impossible to ascertain the facts. A position which may have a maximum error of 0.04 inch, or 200 feet on the ground at the scale of 1:62,500, may have a maximum error of 0.2 inch on the map at 1:12,000. The size of the conventional symbols used may increase this error further. There is little value to be gained from trying to compile a map on the scale of 1:100,000 from source material at 1:500,000. Compilers have not always been careful in this respect, and some medium-scale compiled maps should be used with caution. Map sources are full of cumulative errors from this faulty practice.

Finally, the general appearance and the detail of the map text may be a guide to its accuracy where there is no knowledge of the existence of ground surveys on a sound basis. Density of detail and types of features delineated are partially indicative. Improbable interpretations of geographical features revealed by examination may be a further clue. Are rivers shown in straight, sweeping lines in flat country? Are contours shown in smooth, parallel lines? Are villages shown without a road or track leading to them? Do streams run uphill? These and other improbable details should be watched for. It is advisable to read reports on the area involved before appraising its maps, so as to be able to observe any obvious contradictions that exist. In addition, examination of the map by an individual who has been over the ground the map covers may be valuable, although two difficulties present themselves: finding an individual who has been in the area, and ascertaining the trustworthiness of his knowledge.

Comparison of materials is the next step when the source material has been listed and appraised. Examination will have shown what pieces of information are available from each item of source material and what is common to several pieces. It is necessary to compare the common information to provide relative standards of accuracy for each feature. In some cases the base map or maps to be used can be established from the original appraisal. Features of other materials with the descriptive information gleaned from written sources can then be checked against this basic material for alignment, position, and classification Sometimes no one map can be used as a suitable base for comparison of various features. Thus a different map may have to be selected as a basis for comparison of each feature. The relative standards of accuracy of features will be allotted automatically as

a result of the comparisons made. It is important to avoid a prejudice in favor of one piece of material during this process. Systematic tabulation by check list is one way to prevent short cuts leading to such prejudices.

With completion of the listing and appraisal of each item and the comparison among items, decisions as to the use of source material can be reached. These decisions are the basis for writing the instructions and specifications for the compiler. They should be clear enough so that there are no ambiguities and should visualize the problems that the compiler will meet and try to answer them. Each feature should be tabulated, and instructions given as to the source from which it is to be taken. Under mass-production methods, with relatively untrained personnel, the general accuracy of the map depends on the care with which these steps have been taken. A mistake in the selection of one piece of source material or in the treatment of one feature may destroy the ultimate value of the final map.

Problems of place names. Another major problem of map compilation that the global nature of the war accentuated was that of place names. In 1799 W. Eton, an Englishman, clearly defined a difficulty that geography has so far failed to solve:

> Where the orthography of names is established by long custom we must, I suppose, continue to use it. . . . Where this is not the case, we must spell names as the natives do, if they make use of the Latin characters; if we do not, we must either write their character, or make use of letters of our own alphabet that will produce, as near as possible, the same sounds; or without any regard to the sounds that answer to their letters. I will not decide which method ought to be followed, or which is the real language of a people whose orthography is fixed, the oral or written. I will only observe that it is very difficult to render the principal sounds of one language by letters of another, not to mention modifications; and this is particularly so to the English, whose vowels have very uncertain pronunciation.

The ensuing years of endeavor have failed to solve the problem of how to write geographical names for international use. Mr. Aurousseau, Secretary of the Permanent Committee on Geographical Names for British Official Use, commenting on the problem, says:

> The main question still remains open, as Eton left it in 1799. Time has secured, however, a small negative advantage. Belief in the possibility of international romanization has been shaken. Without an internationally accepted Roman alphabet, international romanization cannot be achieved, but the different values assigned to *c*, *g*, *h*, *j*, *v*, *w*, *x*, *y*, and *z*; the variety and inadequacy of devices for indicating aspirations, palatization, nasalization and yodization; and the poverty of means for indicating stress, quantity and tone, in western European alphabets, have defeated all efforts to establish one.

In the past relatively little progress toward a satisfactory solution of the place-name problem has been made. War on a global scale made some sort of solution necessary even though it might be temporary. Unfortunately, decisions had to be made under pressure of time, with comparatively little opportunity for research, and under influence of military requirements.

A geographical proper name serves to distinguish the place or feature to which it belongs from all other things. To prevent confusion in the use of military maps and in communications, there should be consistency in geographical nomenclature. But no international set of rules and principles has ever been agreed on and adopted. The result is that each country and publishing agency has adopted its own policy. The problem from a military standpoint is to establish a policy for treatment of place names that will lead toward consistency, if not actually achieve it: a policy that will enable the map maker in Washington, London, or New Delhi to take source material made under various editorial practices and arrive at a common result. The problem is twofold: that of establishing a suitable working policy, and putting the policy into effect.

Some of the questions which must be answered by a comprehensive place-name policy indicate the scope of the problem:

1. Should conventionalized names such as "Leghorn" for *Livorno* be used because they are so familiar?
2. Should there be a policy of conventionalized names for small-scale atlas maps and of local names for maps at a larger scale?
3. Should all names adopted by the International Postal Union be accepted?
4. Should names be written so that they can be pronounced easily or at least so that we think we can pronounce them easily?
5. Should all diacritical marks be eliminated because of cartographic and telegraphic transmission problems?
6. Should generic parts of place names always be translated, or should they be translated in some languages and not in others? Some people will not hesitate to translate the Russian word *Reka* into "river" in a place name, but will hesitate to render an Icelandic name such as *Vatnajokull* into "Vatna Ice-Cap," since the generic term and its associated specific part is written as a single word.
7. To go a step further, should the specific as well as the generic part be translated, especially if they are descriptive?
8. If an Englishman discovers and names an island which later becomes a French possession, should the French translation of the name be used if it occurs on official government maps of the area?
9. If the political sovereignty of an area changes should place names be affected?
10. Should the official government name be used in preference to a local name if a difference exists between the two?
11. When a country (such as Belgium or Switzerland) using the Roman alphabet has two or more official languages, which should be used?
12. When two or more countries use the same native language, but fall into different spheres of political control (e.g., Egypt, Algeria, and Spanish Morocco), should a common system of transcription be applied?
13. How should names of international zones and condominiums be treated?
14. If a feature is common to two or more countries with different languages, what name should be applied?
15. When should a local official name be used and when should a conventional English name be used in referring to bodies of water?

Non-Roman script languages and nonalphabet languages raise further problems:

1. Should an official transcription system when offered by a country be accepted?
2. Should transcription systems be letter for letter and reversible, should they be phonetic, or should some compromise be made between these extremes? Should they be broad or narrow systems?
3. If a system of transcription has been in existence for many years, should it be discarded in favor of a new and better system?
4. When no system exists, how does one develop a system acceptable to the various interests involved?
5. If numerous dialects of a language exist, or if it is spoken and not written, or if there is a difference between the spoken and written language, how should one proceed?
6. In nonalphabet languages, should hyphens be used to separate characters and what parts should be separated and capitalized?

Every one of these questions arose in connection with the preparation of place names on maps in the last war. For some, satisfactory solutions for the duration were reached. For others, no completely satisfactory solution can be found until research on the ground can be carried out. The scope of the problem, involving millions of names, made it impossible in most cases to work on the basis of individual name decisions. It was a problem of establishing rules and principles that could be applied to names for whole areas or countries and that would result in a treatment of place names at least satisfactory for the duration. Unfortunately, mistakes made cannot easily be erased because of the millions of maps involved and because of the great cost of transcribing millions of names from nonalphabet and non-Roman script languages.

From a military standpoint, the treatment of place names should accomplish at least five purposes:

1. A place name should always be spelled in the same way, not only on large-scale maps but also on small-scale ones. This consistency of spelling is of first importance.

2. Spelling insofar as possible should be that given on official government maps of the country involved. This is necessary because the maps provided for operations in an area may be partially compilations and partially facsimile copies of original official topographics.
3. A name that will be recognized locally is usually preferable to a name foreign to the area.
4. If possible the name should be written so that the soldier will be apt to give at least an approximation of the local pronunciation.
5. The rule or rules should be such that they are mechanically feasible in their fulfilment.

The United States Board on Geographical Names and the British Permanent Committee on Geographical Names each has established principles and laid down rules with respect to place names. They have been stated respectively in the *Sixth Report of the United States Geographic Board, 1890 to 1932* and in the British report *Alphabets of Foreign Languages*. Unfortunately, they apply only to English-speaking countries and have not necessarily been followed by other countries. In addition, the basic principles and rules are not sufficient to cover many existing problems. They provide an excellent foundation on which policies can be built.

It is not possible to examine each of these principles and rules here, but several of them should be mentioned. The local-name principle and Roman-alphabet rule are perhaps the more important. The seventh International Geographical Congress in Berlin, in 1899, decided that native names, established as accurately as possible, should prevail over all others. This principle has had its ups and downs. Today it is supported by both Britain and the United States. From it developed the Roman-alphabet rule, that local geographical names in each country, dominion, colony, protectorate, or possession in which a Roman alphabet (including Latin alphabets with modified or extra letters) is habitually or alternatively used shall be spelled in accordance with local official usage. In addition, accents and diacriticals should be retained if employed in the language of the country involved.

In practice this rule greatly simplifies the treatment of names over large parts of the earth's surface. It means that when compiling a map one can copy geographical names, with only minor reservations, directly from official maps published by the country that governs the area involved. Difficulty is encountered when there have been changes in the orthography of a country, as in the case of Norway, and when the official local policy of a country is not clearly defined, so that its own maps do not agree. When these problems arise it is necessary to adopt some expedient. As an example, the Dutch about 1935 adopted a change in their system of Malayan transcription involving the substitution of the letter "o" for the letter "$\overset{oo}{a}$." On Army Map Service large-scale maps in the area it was mechanically impossible to make the change because many of the maps were facsimile reproductions. In addition, there are comparatively few people technically qualified to identify these Malay names among the thirty or forty other native languages in the area. On smaller-scale regional maps, International Maps on the scale of 1:1,000,000, and even on the scale of 1:250,000, the necessary changes have been made.

A second principle is that names written in non-Roman script should be transliterated or transcribed into our alphabet with as little loss of identity, either of sound or appearance, as is consistent with the process. This sounds simple; the accomplishment is difficult indeed. The rule that resulted from this principle is that names in countries which use non-Roman alphabets or scripts, or which have no system of writing, should be rendered in the English form according to the R.G.S. II System. This system is an alphabet, not strictly speaking an English one because it represents vowels as in Italian, developed by the Royal Geographical Society. It is followed also by the

U. S. Board on Geographical Names. This alphabet, for which comparative tables have been prepared for many non-Roman languages, does not completely solve the problem. Special tables have been prepared recently for Russian, Greek, and Serb. In a nonalphabet language such as Chinese, a completely satisfactory transcription system is difficult to devise. In southern Asia it is expedient to adopt the names used by the Survey of India, which has carried on ground surveys and published most of the large-scale maps in the area. These are a few of the exceptions to the general rule.

Space does not permit further discussion of the problem of place names. The revival of the Board on Geographical Names, with a large staff to do the necessary research in connection with existing problems, will help make satisfactory solutions available and will bring about consistency between map-producing agencies, at least in this country. There are other problems in connection with map editing that are as interesting and vital as the two I have discussed. Problems in connection with map design, the interpretation of foreign signs, symbols, and conventions, the preparation of glossaries, the size and style of type, and problems in connection with geodesy, such as projections and military grids, are examples of these.

In conclusion, one should remember that map making is not wholly a science; it is partly a subjective process involving qualities of integrity, judgment, and critical acumen. Unfortunately, a well-drafted and printed map has an appearance of accuracy. It is not like a printed text, in which statements can be carefully qualified, and it should be used, therefore, critically as well as with understanding. Mr. John Wright, of the American Geographical Society, has stated the situation excellently:

> Like carpenters' tools, maps should not be misused. More should not be expected of them than they can perform. Sometimes when a critic damns a compiled map because he has found errors on it in a region that he has visited, his condemnation may reveal ignorance of the nature of cartography on his part rather than carelessness on the part of the map maker. Not all maps can be based on new surveys. Errors that originated in the sources of a compiled map frequently could have been avoided only by not making the map.

BACK ISSUES WANTED

The unexpected addition of more than 2,000 new A.A.A.S. members between January 1 and May 1, 1947, has led to a shortage of copies of the February, March, May and June 1947 issues of The Scientific Monthly. *The reason for this shortage is that each new member in the first six months of the year has been sent back issues of the journal of his choice. Receipt of copies of these issues from members who do not maintain permanent files will be greatly appreciated. They should be sent to: American Association for the Advancement of Science, 1515 Massachusetts Avenue, N.W., Washington 5, D. C. Postage will be refunded.*—Ed.

CRIMINAL LAW FOR ATOMIC SCIENTISTS

By LEONARD H. LEVENSON

Mr. Levenson (B.S., Carnegie Institute, 1935), formerly a physicist and now a lawyer, is at home in both laboratory and courtroom. He has worked at the National Bureau of Standards, the Carnegie Metals Research Laboratory, and the U. S. Bureau of Mines, where he was physicist in charge of Navy work on explosion-proof electrical equipment. In addition to his private practice, Mr. Levenson is associated with the Legal Aid Society of Pittsburgh.

AMONG the minor repercussions of the explosion of the first atomic bomb was the linking together of two theretofore widely separated fields of knowledge — criminal law and nuclear physics. More exactly, the connection was made by the Atomic Energy Act of 1946, which, incidental to its general purpose of providing for the development and control of atomic energy, creates a number of new criminal offenses and specifies penalties for them. It is the purpose of this article to outline these offenses and penalties in conjunction with brief explanations of pertinent elementary principles of criminal law, and thus to dispel the unfounded fears of some physicists that nuclear research is to be greatly restricted under the Act and the illusions of others that such mundane matters as the Act and regulations issued under it are of no concern to workers in the ivory towers of pure science. As reassurance to the former, it is pointed out that one of the major purposes of the Act is, in its own words, ". . . assisting and fostering private research and development to encourage maximum scientific progress . . ." in connection with atomic energy, and that restrictions on research activities have been kept to the minimum compatible with security requirements. As warning to the latter, on the other hand, it is pointed out that the penalties for violations of the carefully defined offenses in the Act are severe, ranging up to imprisonment for life and the death penalty itself, and that investigations of violations are expressly placed under the jurisdiction of the Federal Bureau of Investigation.

Before discussing its criminal aspects, the rationale of the Act will be given in order that the necessity for its various prohibitions may be better understood. Briefly, the Act seeks to control atomic energy by controlling the production, possession, and utilization of fissionable material, which is defined as meaning plutonium, U-235, or any other material capable of undergoing nuclear chain reaction. The title of all fissionable material is vested in the Atomic Energy Commission, which also owns all production facilities (plutonium piles, electromagnetic or diffusion isotope separators, etc.). The Commission may operate its production facilities itself or arrange for their operation by private contractors. Source materials (uranium, thorium, etc.) remain under private ownership, but all transfers must be licensed by the Commission. The manufacture of devices utilizing atomic energy, such as atomic-powered electricity-generating plants, must be licensed by the Commission. Generally, research activities are expressly exempted from these prohibitions. For example, Section 4 (*c*) (1), which provides for exclusive Commission ownership of production facilities, exempts facilities that are useful for research and that ". . . do not, in the opinion of the Commission, have a potential production rate adequate to enable the operator of such facilities to produce within a reasonable period of time a sufficient quantity of fissionable material to produce an atomic

bomb or any other atomic weapon." Clearly, an ordinary mass spectrograph, being useful for research and being incapable of producing (separating) U-235 faster than the order of one gram per century, would be exempted under this provision.

The offenses created by the Act may be divided into three general categories: (1) those pertaining to the control of information; (2) those pertaining to the possession of fissionable material, production facilities, and atomic weapons; and (3) those pertaining to reporting and inspection regulations issued by the Commission under the Act.

All offenses in the first category, together with their penalties, are contained in Section 10 (*b*) of the Act. This section, after defining "restricted data" as meaning ". . . all data concerning the manufacture or utilization of atomic weapons, the production of fissionable material, or the use of fissionable material in the production of power . . ." unless publication is approved by the Commission, prohibits the disclosing, obtaining, destroying, etc., of restricted data. Section 10 (*b*) (4), which pertains to destroying and whose wording is typical, is quoted below:

> Whoever, with intent to injure the United States or with intent to secure an advantage to any foreign nation removes, conceals, tampers with, alters, mutilates, or destroys any document, writing, sketch, photograph, plan, model, instrument, appliance, or note involving or incorporating restricted data and used by any individual or person in connection with the production of fissionable material, or research or development relating to atomic energy, conducted by the United States, or financed in whole or in part by Federal funds, or conducted with the aid of fissionable material, shall be punished by death or imprisonment for life (but the penalty of death or imprisonment for life may be imposed only upon recommendation of the jury and only in cases where the offense was committed with intent to injure the United States); or by a fine of not more than $20,000 or imprisonment for not more than twenty years, or both.

Stripped of its necessary but confusing synonyms, the above-quoted section makes it a crime to tamper with anything involving restricted data and used in connection with fissionable material or with federally conducted or financed atomic energy research, if done with a specific intent. If done with intent to injure the United States, the maximum punishment is life imprisonment or death, if the jury so recommends; if done with intent to secure an advantage to a foreign nation, the maximum punishment is imprisonment for twenty years.

The phrase "with intent to injure the United States or with intent to secure an advantage to any foreign nation" constitutes a very strong protection for the scientist against an unwarranted conviction for an inadvertent or noncriminal violation of the technical wording of the Act. For the commission of the crime, there must be both the criminal act and, in conjunction therewith, the specific criminal intent. The burden is on the prosecution of proving the specific intent required, and merely proving a general criminal intent will not suffice for a conviction. For example, suppose that a laboratory assistant, incensed at being discharged for incompetence, deliberately burns a laboratory notebook containing restricted data by way of wreaking personal revenge on his superior responsible for his discharge. He would be entitled to be found not guilty of violating Section 10 (*b*) (4), quoted above, because he lacked the intent to injure the United States or to secure an advantage to any foreign nation.

All the offenses pertaining to control of information, with one exception, require the above-quoted specific intents. The exception is Section 10 (*b*) (2) (*B*), which provides punishment for anyone who discloses restricted data ". . . with reason to believe such data will be utilized to injure the United States or to secure an advantage to any foreign nation. . . ." This would cover a situation where a susceptible scientist discloses restricted data to the beautiful spy familiar to every movie-goer. Even though his intent is only to win her favor and he has

no knowledge of her connection, he would be guilty of violating this section, for he would have reason to believe that her interest in atomic research was more than mere feminine curiosity.

Another protection of the atomic energy scientist in connection with control of information prosecutions is the provision of Section 10 (*b*) (5) (*A*) that no such prosecution shall be commenced except upon the express direction of the Attorney General of the United States, and only after he has advised the Commission with respect to such prosecution. Inasmuch as in the case of other crimes any person may commence prosecution merely by making a complaint under oath before a proper official, this provision is assurance that prosecutions will not be initiated before review by persons having the scientific background necessary for understanding the significance of the acts complained of, thus eliminating the danger of unwarranted prosecutions by overzealous and misinformed public officials or private individuals.

Still another protection is the provision of Section 10 (*b*) (6) that prohibits other government agencies from taking any action inconsistent with that of the Commission with respect to control of information. Thus, if the Commission permits the publication of data previously declared restricted, no other government agency can prohibit its publication, and the scientist is protected against conflicting orders and rulings from various government bureaus.

The penalties for offenses pertaining to fissionable material, production facilities, and atomic weapons are provided in Section 16 (*a*) of the Act, which provides as follows:

> Whoever wilfully violates, attempts to violate, or conspires to violate, any provision of sections 4 (b), 4 (e), 5 (a) (3), or 6 (b) shall, upon conviction thereof, be punished by a fine of not more than $10,000 or by imprisonment for not more than five years, or both, except that whoever commits such an offense with intent to injure the United States, or with intent to secure an advantage to any foreign nation shall, upon conviction thereof, be punished by death or imprisonment for life (but the penalty of death or imprisonment for life may be imposed only upon recommendation of the jury and only in cases where the offense was committed with intent to injure the United States); or by a fine of not more than $20,000 or by imprisonment for not more than twenty years, or both.

Section 4(*b*) prohibits the ownership by any person of facilities for the production of fissionable materials or the producing of fissionable materials except as duly authorized by the Commission; Section 4 (*e*) prohibits the manufacture or transfer of production facilities without Commission authorization by license; but exempts such manufacture or transfer when incidental to research; Section 5 (*a*) (3) prohibits any person from possessing or transferring fissionable material without Commission authorization, from importing or exporting fissionable material, and from producing fissionable material outside the United States; and Section 6 (*b*) prohibits any person from making or acquiring any military weapon utilizing atomic energy except as authorized by the Commission, but exempts research activities.

Unlike the first category of offenses, in this second category a specific intent is not essential for the commission of the offense; if present, the specific intent serves merely to aggravate the offense and increase the penalty. It is only necessary that the unlawful act be done willfully. In the language of criminal law, "willful" means voluntary and intentional and implies also a guilty mind.

To be guilty of an attempt to commit a crime, one must do more than intend and make preparations to commit it. He must commit an overt act tending to complete the crime and going beyond mere preparation. It is otherwise, however, in the case of conspiracy. If two or more persons agree to commit a criminal act, they are then guilty of the crime of conspiracy, even if they

subsequently change their minds and commit no overt act in furtherance of their agreement.

The penalties for offenses pertaining to reporting and inspection requirements are contained in section 16 (*b*), which provides:

> Whoever wilfully violates, attempts to violate, or conspires to violate, any provision of this Act other than those specified in subsection (a) and other than section 10 (b), or of any regulation or order prescribed or issued under sections 5 (b) (4), 10 (c), or 12 (a) (2), shall, upon conviction thereof, be punished by a fine of not more than $5,000 or by imprisonment for not more than two years, or both, except that whoever commits such an offense with intent to injure the United States or with intent to secure an advantage to any foreign nation shall, upon conviction thereof, be punished by a fine of not more than $20,000, or by imprisonment for not more than twenty years, or both.

Section 5 (*b*) (4) requires reports to the Commission of the possession, transfer, etc., of source materials; Section 10 (*c*) authorizes the Commission to require reports and inspections of atomic research activities carried on by private institutions under contract with the Commission and of activities relating to the utilization of atomic energy, and directs the Commission to require reports and inspections of the production of fissionable material in the conduct of research; Section 12 (*a*) (2) authorizes the Commission to establish health and safety regulations for the possession and use of fissionable and by-product material (nonfissionable radioactive material produced incidental to the production or utilization of fissionable material). Included in the catchall provision of this section would be a violation of Section 11 (*a*) (3), which requires that any invention or discovery useful in the production of fissionable material or in the military application of atomic energy be reported to the Commission within sixty days.

The Act also authorizes the Commission to apply for court orders enjoining violations or enforcing compliance with the Act, the Commission's regulations, and with subpoenas issued by the Commission in connection with hearings held by it. Failure to obey such a court order constitutes criminal contempt of court and, as such, is punishable by imprisonment.

There have long been criminal penalties on our statute books for physicians who unlawfully dispense narcotic drugs or who perform illegal operations, and for lawyers who embezzle clients' funds or who suborn perjury, but the existence of these criminal penalties has never been considered as impugning the professions of medicine or law as a whole. Similarly, the inclusion of criminal penalties in the Atomic Energy Act should not be viewed as a slur on the loyalty or integrity of atomic scientists, but rather as recognition of their new importance. Atomic science has now reached full stature as a profession in the sense that the activities of those engaged in it are a matter of such great public interest that the public must protect itself by criminal penalties against possible wrongful activities.

THE RESEARCH COUNCIL ON PROBLEMS OF ALCOHOL

By JOSEPH HIRSH

Mr. Hirsh has spent over a decade in the health and welfare field. Trained originally in the biological sciences, he took a graduate degree in sociology at Columbia University and is just completing his doctorate in education at New York University. During the war, among other assignments, he served as Public Health Education Officer on Nelson Rockefeller's staff in Central and South America and as Chief of Preventive Medicine, A.A.F., in Italy.

THE Research Council on Problems of Alcohol (60 East 42nd Street, New York City 17), a nonprofit, membership corporation organized in 1937 and incorporated in the District of Columbia in 1938, is an associated society of the A.A.A.S. The present membership of the Research Council is composed of approximately 1,000 individuals and groups. The privileges of membership include:

1. Participation in a major public health movement.
2. Subscription to the *Quarterly Journal of Studies on Alcohol.*
3. Subscription to the bulletin *Alcoholism.*
4. Reprint packets.
5. Research studies and publications.
6. Information services.
7. Technical consultation services.

The Council's objectives are to stimulate, initiate, sponsor (through grants-in-aid), and evaluate research in the problems of alcohol and in the treatment of problem drinking; to discover the causes and means of prevention of problem drinking; and to develop effective methods of diagnosis, treatment, rehabilitation, and specialist training.

The Research Council is primarily concerned with research and secondarily with education and information. Four problems have become manifestly clear to its administrative officers: first, that no single agency, operating in this field, can by itself render the large public service necessary to the solution of the complex research, medical, educational, social, and legislative questions involved in dealing with problem drinkers; second, that education—public and professional—and the creation of an atmosphere of understanding is necessary for the support of institutional and medical programs, scientific inquiry, and social action; third, that confusion exists in the minds of physicians, laymen, jurists and legislators, and public-spirited citizens as to methods needed to meet local problems; fourth, that the research and education undertaken heretofore have been, with few exceptions, too scattered and uncoordinated.

In an attempt to stimulate and establish research and treatment projects and standards of diagnosis, treatment, and rehabilitation, the Research Council has been working with and through such official and nonofficial agencies as the Veterans Administration, United States Public Health Service, American Medical Association, American Hospital Association, National Committee for Mental Hygiene, and others.

In the field of education, in an effort to establish public acceptance of the medical nature of problem drinking and of the need for research and medical action, the Research Council has been working with such voluntary agencies as the National Committee for Education on Alcoholism, the Yale School of Alcohol Studies, and certain religious groups and organizations.

Broadly speaking, the education and public relations program of the Research Council is designed to meet two needs: first, the dissemination of scientific information on the problems of alcohol in a socially useful manner through the distribution of publications reporting the best scientific data; and, second, the furnishing of adequate interpretation of the results of scientific inquiry through major media of information (that is, the press, magazines, and the radio and motion-picture

industries), so that intelligent social understanding and action may result.

In the first category, the Research Council has distributed tens of thousands of pieces of literature, both lay and technical, regularly to its membership and upon request to individuals and agencies. Within the past several months alone more than 9,500 pamphlets, technical papers, monographs, and reprints have been distributed either at cost or free of charge. In the second category, the Research Council is assisting newspaper and magazine writers and editors in the planning, review, and preparation of articles. Specialists within the Council are available and are serving as technical consultants in the preparation of motion pictures. Representatives of the Council have assisted, and are continuing to assist, in the development of radio programs, both local and network, on problem drinking.

In addition to those officers of the Council with permanent teaching affiliations, other officers are serving as guest and visiting lecturers before university classes, professional societies, and public groups generally in the formal areas of education.

With the cooperation of graduate students of hospital administration at Columbia University College of Physicians and Surgeons (School of Public Health), a master plan of inpatient and outpatient service in general hospitals for problem drinkers is being developed for the guidance of hospital administrators.

WITH the growing acceptance of the medical nature of problem drinking and the need for medical facilities for alcoholic patients, a number of states (and the Federal government, acting for the moment in the specific interest of the District of Columbia) have been pressing for legislation for the establishment of official commissions to study these questions and for clinic, hospital, and special facilities for the care of problem drinkers. Officers of the Research Council have assisted public and private groups in the analysis of proposed legislation and have testified in public hearings considering it.

Working with interested professional and nonprofessional private agencies, the Research Council plans to develop a framework of model national, state, and municipal laws and the recodification of existing laws pertaining to alcoholics, toward the end that these drinkers will come under the jurisdiction of health rather than of correctional authorities. This newly developed activity of the Research Council will assist present and future legislators and state commissions on alcoholism in the analysis of local problems and the preparation of adequate legislation to meet them.

Heretofore, research in this field has been largely segmentalized. In order to make it more effective, the Research Council is concentrating on a program of integrated research by establishing model research, diagnostic, treatment, and teaching centers in leading medical schools and their affiliated hospitals. Thus fundamental research and the preclinical and clinical sciences will be focused on the individual problem drinker in such a fashion as to develop sound scientific methods of diagnosis, treatment, prevention, and rehabilitation, as well as of education, both lay and professional.

In the field of research, the Scientific Board of the Research Council has reviewed approximately 200 individual projects in many areas. New proposals for research and requests for grants-in-aid reaching the Research Council from scientists will, upon approval, be incorporated in this program.

The first of several research, diagnostic, treatment, and teaching centers was established at Cornell University Medical College (The New York Hospital) in January 1947. This project was underwritten, for a five-year period, at the rate of $30,000 per year, by the Research Council, assisted by a special fund for research contributed by several leading companies of the licensed-beverage industry.

Among the "links" tentatively selected for the chain of centers are the New York University College of Medicine–Bellevue Hospital; the Langley-Porter Clinic, University of California, in San Francisco; and the Los Angeles County General Hospital, University of Southern California Medical School, in Los Angeles. The selection of these and other institutions is based upon their special interest, facilities, and personnel. The ultimate intention is to have the various researches undertaken by each "mesh" so as to cover the entire problem area without duplication. Cooperation in, and financial support for, these research centers are being sought from interested government agencies and from private foundations, industry, and individuals.

The future operations, both immediate and long-range, of the Research Council are visualized primarily as an extension and expansion of present activities. Serving, as the Council does, in part as a clearinghouse and in part as a stimulating agency, continuing relationships with both official and nonofficial agencies will be maintained for the following purposes:

Research:

To establish integrated research programs in terms of—

1. Fundamental research in colleges, universities, and research hospitals.
2. Research, diagnostic, treatment and teaching centers in such government institutions as Veterans Administration, U. S. Public Health Service, and state and local general hospitals.
3. Research centers or institutes in medical colleges and their affiliated hospitals and in certain selected general hospitals.

Service:

1. To assist in the provision of medical service to problem drinkers (Veterans Administration, U. S. Public Health Service—specifically, the marine hospitals—state departments of health, institutions and agencies, and public general and special hospitals).
2. To develop an over-all approach to problem drinking for the guidance of state health officers and for communities (U. S. Public Health Service, state departments of health, institutions, agencies, legislatures, and planning commissions).
3. To develop standards of differential diagnosis, treatment, prevention, and rehabilitation (The American Medical Association, The American Psychiatric Association, National Committee for Mental Hygiene).
4. To develop model Federal, state, and municipal laws for guidance in the provision of medical care for problem drinkers (The American Medical Association, The American Psychiatric Association, The National Committee for Mental Hygiene, The American Bar Association, and local affiliates).
5. To develop standards of operation of facilities for the medical care of problem drinkers, and a directory of accepted institutions (American Medical Association, American College of Surgeons, American Hospital Association).
6. To encourage the effective use of existing clinic, hospital, and other institutional facilities for the medical care of problem drinkers (The American Hospital Association, its state and local affiliates, and state departments of health, welfare, mental hygiene, and institutions and agencies.

Education:

To develop public acceptance of the medical nature of problem drinking and of the importance of scientific research in the solution thereof, through the major media of information and other agencies that have had long and fruitful experience in this field (Yale School of Alcohol Studies, National Committee for Education on Alcoholism).

While these are suggestive lines of future development and activity, growing out of the exigencies and demands of the past months, they are subject to modification and expansion.

ARRANGING MEETINGS OF THE A.A.A.S.

By JOHN M. HUTZEL

Assistant Administrative Secretary, A.A.A.S.

IN THE three years immediately following its first meeting on September 20, 1848, the A.A.A.S. held five meetings. In 1852 a meeting scheduled to be held in Cleveland was postponed because of an epidemic of yellow fever raging from the Ohio River southward. No meetings were held during 1861–65, or in the years 1942, 1943, and 1945 of World War II. With these exceptions, the Association has held at least one meeting each year of its existence.

The present-day efficient organization of the annual convention is due to the coordinated efforts of many scientists and lay personnel. First in order of a series of chronological events leading to the opening sessions is the selection of the convention city. During one of its meetings at each annual convention, the A.A.A.S. Council examines the invitations of scientists and convention managers in the larger metropolitan areas and makes its selection according to the facilities placed at its disposal and according to a policy of rotation of the meetings among the principal population centers. For adequate sleeping accommodations, the Association must have a guarantee of nearly 3,500 hotel rooms, and, because most participants desire to hold their meetings in the same hotel in which they have their room reservations, the Association must also have a guarantee of a sufficient number of hotel rooms to house about 300 sessions in six days, with provision for as many as 60 simultaneous meetings. Obviously, there are few cities large enough to provide these essential requirements; and, if meetings are to be held over a wider geographical area, it may be necessary eventually to set some sort of limitation on the number of sessions, or hold seasonal meetings in different cities, restricted to one or two sections and their related affiliated societies.

The date of the meeting is also set by the Council. Since 1902 nearly all annual meetings have been held during the week immediately after Christmas. The suitability of this time for the meeting is periodically reviewed by members of the Council as well as by the officers of the principal societies meeting with the Association. Consistently, the majority have always favored Christmas week in spite of the two major objections, that it immediately follows Christmas Day, and that it is in midwinter when the weather may be disagreeable. Generally speaking, however, it is a time when most conventioners are relatively free from academic and business duties. From the standpoint of obtaining sufficient sleeping and meeting facilities, the Christmas season is the most favorable, because during that period the hotels usually have fewer demands from other travelers.

Early in the year, officers of the A.A.A.S. visit the convention city to meet the sales managers of the cooperating hotels and to inspect the session rooms and facilities for the Science Exhibition. They also meet with representatives of local institutions to lay the groundwork for the organization of the local committees. The procedure usually recommended by these representatives calls for invitations from the Administrative Secretary, on behalf of the officers of the Association, to the heads of the major cultural, educational, and industrial institutions to serve as honorary chairmen of the meetings, and to appoint from their staffs persons particularly qualified to discharge the functions of com-

mittees on Finance, Reception and Entertainment, Registration, Equipment, and Publicity.

While the appointment of committee members is proceeding, letters are sent to the secretaries of all the societies affiliated with the A.A.A.S., inviting them to participate in the meeting. As rapidly as the invitations are accepted, general information about the meeting is returned, including deadlines for filing session-room and equipment requirements and copy for the *General Program*.

The responsibility for preparing the agenda for the special programs rests upon the secretaries of the sections of the A.A.A.S. and of the cooperating affiliated societies. These secretaries, with the help of their respective executive committees, decide the scope of subject matter for each session, the societies and sections which will meet jointly, the speakers, the dates and hours when the meetings will be held during the convention period, and the number of session rooms required. Moreover, they estimate the probable attendance at each meeting, which will determine the size of the rooms assigned for their sessions. To them is due the credit for furthering the aims of the Association through the organization of high-quality, distinctive programs.

The matching of session-room requirements with the session rooms made available by the hotels is done by one of the administrative officers of the Association in order to avoid the general confusion that would result should the secretaries compete with one another in obtaining preferred meeting places in the hotels. It is possible through this coordination to house societies with similar interests in the same or closely adjacent hotels. Scheduling of rooms is not, however, an easy task. Most of the sessions require rooms with a seating capacity of 100 or more, and, unfortunately, it is unusual to find a hotel having as many as six rooms with such a seating capacity. The average number is usually four rooms, varying in seating capacity from 100 to 1,500 or more. Cooperating with the hotels to reduce the costs of labor, the scheduling officer must assign sessions to the same room as often as possible throughout the convention, except in the case of meal functions, which, because of table arrangements, cannot be assigned to rooms occupied immediately beforehand. When one considers in addition the error inherent in estimating the probable attendance at a session six months in advance, it is little short of a miracle when the capacity of the room assigned approximates the actual attendance.

The majority of the 50 or more organizations cooperating with the A.A.A.S. meet for only two or three days during the convention period. Many of these meetings are on different dates, and by staggering the 250–300 sessions it is usually possible to accommodate all the sessions within the hotels. It is difficult, however, to make satisfactory assignments in the case of related societies, for these groups tend to ask for sessions on the same days in order to arrange joint meetings. As a result, it may be necessary to place some of the sessions in hotels other than those assigned as their headquarters, so that flow between sessions is less readily achieved.

As soon as local committee appointments have been made by the cooperating institutions, officers of the Association arrange to meet with each committee to assist in the formulation of plans and policies. The activities of these committees follow:

Finance Committee

Raise funds to meet the expenses of the general reception given to the officers, members, and guests of the Association and its affiliated societies, and to defray the cost of operation of all committees.

Equipment Committee

Procure projection apparatus, contract for opera-

tors, survey session rooms available outside the hotels, and organize teams to take care of emergency requests during the meeting.

Reception and Entertainment Committee
Supervise all arrangements for the general reception, organize special tours, and provide for the entertainment of the women attending the convention and for special entertainment features such as symphony concerts and choir recitals.

Publicity Committee
Publicize the meeting locally, assist in coordinating radio programs, and equip the press room.

Registration Committee
Organize the physical arrangements for registration, establish information centers, and provide special leaflets and other literature describing eating and transportation facilities.

Following a general discussion of these functions, each committee elects its own officers, including a chairman. Collectively, the chairmen constitute the local *Executive Committee*, which in turn elects the general chairman of the convention.

After the initial meetings, the activities of the local committees are largely autonomous. As hosts of the convention, the committee members assume many more functions than have been outlined here, not a few of which exact a great deal of energy and require a generous contribution in time and patience.

By mid-June much of the groundwork for the convention has been laid. During the summer months bids are solicited and contracts awarded for the Convention Badge and for printing jobs, including the *General Program* and registration forms. Not again until September, however, is there an acceleration of activities, when publicity plans are pressed and the secretaries of the sections and societies drive toward the completion of their programs.

One of the Association's aims, as expressed in its constitution, is to "increase public understanding and appreciation of the importance and promise of the methods of science in human welfare." It has, therefore, the task of bringing before the public through press and radio the reports of the scientists who participate in its meetings. Annually, seventy or more press representatives cover the convention, including many members of the National Association of Science Writers, an affiliated organization. Facilities to aid them in their work are provided by the local Publicity Committee and supervised by a press director, who, prior to the meeting, is charged with the responsibility of forwarding advance copy obtained from the authors to press bureaus and science writers throughout the nation.

It is obviously impossible to direct public attention to more than a small fraction of the 1,300–2,000 papers presented at the meeting. Not only do many of the papers lack news value, but few science writers have the time, let alone the background, to adequately interpret on a popular scale reports from the widely varying fields of science. Unfortunately, also, there appear to be only a few scientists who can report their work in a manner both clear and interesting to the layman. And as specialization becomes more intense, there are many subjects that resist popular interpretation. As a result, the secretaries of the sections and societies are called upon to evaluate the papers to be given on their own programs and select those which in their opinion represent outstanding contributions to the advancement of science. A complete copy of each chosen paper, together with an interpretive abstract by the author, is then forwarded to the press director, who sends mimeographed copies to accredited science writers and also provides copies for press-room distribution during the meeting. To reduce the hazard of inaccurate reporting that sometimes results from the race to meet deadlines, it is necessary that these papers and abstracts be in the hands of the press director at least two

weeks before the meetings. Copies can then be forwarded to the science writers in time for them to study and interpret the subject matter or seek authoritative advice if necessary. To ensure general distribution of his report, each author is urged to send 50 copies of his paper directly to the press director well in advance of the meeting.

The secretaries also forward to the press director abstracts of all the other papers to be presented at their sessions. These are kept on file for the inspection of writers before and during the meeting. The Association reserves publication rights only on papers presented at its general sessions and before its sections. No other papers are reviewed for publication by the editors of *Science* or THE SCIENTIFIC MONTHLY. For publication in either of these journals, manuscripts of papers presented before meetings of the societies must be submitted directly to the respective editors.

Few meetings offer more material suitable for broadcasting than the meetings of the A.A.A.S. For six days, workers in all the major fields of science, from all parts of this country and many foreign countries, are congregated in a large city with ample broadcasting facilities. Scheduled for discussion are subjects having local, regional, and national interest—subjects readily translated into forum- or interview-type radio programs. In organizing the programs of the sections and societies, the secretaries are asked to suggest topics and panels of speakers. These are submitted for approval to the managers of the local radio stations, and those selected are referred to the proposed participants with notice of probable date of live broadcast or recording for delayed broadcast. Shortly before the convention, final schedules are worked out and arrangements made for preliminary discussions in the convention city between the speakers and the station representatives.

As the programs of the sections and societies materialize, a synopsis of each is printed in one of the Association's journals, along with general announcements of meeting arrangements, including the hotel headquarters assignments and room reservation forms. An A.A.A.S. Housing Bureau is established in the convention city. Guests seeking sleeping accommodations list three hotels in the order of their preference, and placement is made according to the availability of the type of room requested at the time the reservation is received. Assignment in the hotel of first choice is more likely in those cases where friends are willing to share rooms than when requests are made for the less numerous single rooms. The Housing Bureau may save the conventioner much needless correspondence in obtaining room reservations, for if accommodations are not available at the hotel of first choice, the reservation request is quickly referred to other hotels.

Concurrently with the development of the programs of the sections and societies, the administrative officers of the A.A.A.S. organize a number of general and special sessions such as award ceremonies, the A.A.A.S. Business Meeting, the Academy Conference Dinner, the Secretaries' Luncheon, joint meetings with the Society of the Sigma Xi and Phi Beta Kappa, exchange lecture with the British Association for the Advancement of Science, and others. These programs are designed to give leading educators, research specialists, statesmen, and industrialists an opportunity to express themselves before a general audience on subjects of current importance to all scientists.

Toward the end of September the secretaries are reminded of the deadlines set for the submission of program copy, equipment needs, abstracts for the press, and broadcasting plans. The *General Program* is made available December 1 in order to permit the conventioner time to study the entire

agenda and decide which sessions to attend. Those who wish to register in advance may obtain a copy of the *General Program* before the meeting by sending the registration fee to the Assistant Administrative Secretary of the Association before December 1.

In order that the program may be available for mail distribution, it is necessary that program copy be submitted to the Washington office not later than October 21. It is desirable to have as much copy as possible from the secretaries of the sections and societies prior to this date so that it can be retyped to conform with the standard style and so that the galleys can be corrected in time to meet the printer's deadline of November 15. Approximately two weeks are required to print and bind the programs and prepare them for mailing after the final corrected proofs have reached the printer.

A schedule of the equipment requirements for each session is filed with the Association at the time the program copy is submitted. These schedules are forwarded to the chairman of the local Equipment Committee, who arranges for the rental of projection apparatus and the hiring of union operators. As a rule, union operators must be paid a flat rate of so much a session, regardless of the time actually spent in operating the machines. Projection of but a single slide therefore costs as much as the continuous showing of slides for a three-hour period. Moreover, some unions require a different operator for each type of projection apparatus. Most meetings of the Association require twenty $3\frac{1}{2}'$ x $4'$ and twelve $2'$ x $2'$ slide projectors, as well as six or more 16-mm. motion-picture projectors, because of the large number of sessions needing projection equipment that may be in progress at the same time. Other types of projectors and special adapters are often needed for the 130 or more sessions using equipment of this kind during the convention period. Members of the local committee visit each room scheduled for projection and determine the position of the machines according to the focal length and size of screen necessary to provide optimum visibility to a capacity audience.

In addition to projection apparatus, microscopes are needed for demonstration programs, along with special laboratory accessories that frequently must be obtained directly from the manufacturers. Public address systems are required for all the larger meetings. The cost of providing equipment and arranging for storage, transportation, and insurance is approximately $2,000. This is not a large sum, but it does add substantially to the total expense of the meeting, which is estimated to be $28,000, exclusive of the charges sometimes made for the use of hotel session rooms. The secretaries are therefore urged to schedule papers requiring projection apparatus in one or two sessions, and to accede to requests for equipment only in the case of demonstration programs or if absolutely necessary for clear exposition.

In general, the costs of the meeting are defrayed by income from three sources: registration, the Science Exhibition, and funds raised by the local Finance Committee. If the income is insufficient to meet expenses, the deficit must be paid out of the Association's reserves. These reserves are derived solely from the membership dues and operations of the Association, for the affiliated and associated societies do not contribute in any way to the financial support of the A.A.A.S. Members, and particularly nonmembers, who attend the convention should therefore register, so that expenses will be borne on a prorata basis by those who benefit directly. Registration is not compulsory, but it is difficult to understand the attitude of those who fail to register and at the same time take the advantages of the meetings.

A week or two immediately in advance of the meeting administrative officers of the Association establish headquarters in the convention city to help direct last-minute preparations. Meetings are held with members of the local committees for a general review and summary of their activities and to fix the division of labor that will hold throughout the convention. The session-room assignments of each hotel are examined, and consultations are held with the program directors of the radio stations to confirm broadcast commitments. Of particular importance are the preparations for registration and the construction of the exhibits.

Registration facilities are so arranged as to reduce to a minimum the amount of time necessary to register. Upon presentation of the registration card and fee to an attendant, the convention guest receives a Convention Badge, a copy of the *General Program*, and special literature provided to familiarize those from out of town with the host city. The main registration center is located adjacent to the Exhibition, and, depending upon the disposition of the headquarters hotels and other meeting sites, auxiliary registration desks are set up at places convenient for scientists attending the meeting. Small groups holding their meetings at some distance from the main center of activities are not provided with registration facilities, and it is therefore advantageous for their members to register in advance of the meeting.

Many services are provided conventioners at the main registration center in the Exhibition area. Attendants at the information booth advise registrants about the meetings, transportation, eating facilities, and local points of interest. They also operate a lost-and-found service. Mail and telegrams addressed in care of the A.A.A.S. are held there, and every attempt is made to notify the addressees. The Association does not, however, assume responsibility for their delivery; communications not called for during the convention are returned to the sender. A visible directory also is maintained to assist registrants in locating friends and business acquaintances during the convention.

The Advertising Manager of the A.A.A.S. administers the Science Exhibition held in conjunction with the annual meeting. This is a difficult task, requiring the solution of numerous technical problems during its assembly the week preceding the convention. The exhibits are intended to offer scientists the opportunity to examine at close range recent developments in pure and applied science. Attendants are on hand at the exhibition booths to explain the displays and assist interested persons in selecting equipment or procuring materials to meet their own research requirements. Out of revenue derived from the rental of exhibition floor space to commercial concerns, which, for the most part, are interested in displaying scientific books, apparatus, or supplies, the Association sponsors a large number of special exhibits of outstanding examples of scientific research by individuals, government agencies, or nonprofit institutions.

Aside from newspaper and radio accounts and the activity in the press room, no fanfare accompanies the opening day of the convention. The schedule of meetings, as well as synopses of the programs of the sections and societies, have been given local and national publicity through the Publicity Committee and through the journals of the Association and of the cooperating societies. Thousands of scientists converge on the host city, check in at the hotels, and begin to pursue various activities in connection with the convention. For those who have helped organize the meeting, tension is at a peak. Regardless of the best-laid plans, during the six days of

the meeting countless new problems arise that need quick, positive solutions. Association personnel are stationed at the headquarters hotel and at the Exhibition, where they may be readily reached for assistance. Each session is under the supervision of a presiding officer who, if he possesses foresight, examines the facilities for his meeting at least half an hour in advance to make certain that all is in order and, if not, to call on the officers of the A.A.A.S. for quick adjustments. In general, however, the die is cast, and most of the meeting activities proceed according to plans formulated months before the opening date.

NOR GAUGE THE FRUIT

Not on the surface fix your gaze,
But telescope above, below.
Penetrate the outer glaze . . .
Discern the embryo.

Stretch the vision till the sight
Rests past the moon, behind the sun;
Look deep into the pit of night,
Into the well of dawn.

Nor gauge the fruit by downy skin,
But let the tongue explore
The secret succulence within—
And learn the bitter core.

Knowledge wears a subtle guise;
Her countenance is seen
Only by those who scrutinize
Below . . . above . . . between!

MAE WINKLER GOODMAN

THE CATS-TO-CLOVER CHAIN

By W. L. McATEE

For more than forty years Mr. McAtee was a member of the Fish and Wildlife Service (U. S. Department of the Interior), where he made a reputation in economic ornithology and systematic entomology. His studies of blind fishes caused him to doubt much natural-selection doctrine, and his investigations of the food habits of birds led him to challenge it. A book manuscript, "A Critique of Darwinism," has found no publisher, however. His principal task and pleasure at sixty-four is the preparation of "A Dictionary of American Bird Names."

AT LEAST every hundred years or so, the arguments of science should be re-examined. Among natural-selection speculations, a few have been time-revised, and it is proposed to deal with another here. The doubted remarks are contained in the following disquisition by Charles Darwin on the pollination of heartsease and red clover.

> Humble-bees alone visit red clover, as other bees cannot reach the nectar. It has been suggested that moths may fertilize the clovers; but I doubt whether they could do so in the case of the red clover, from their weight not being sufficient to depress the wing petals. Hence we may infer as highly probable that, if the whole genus of humble-bees became extinct or very rare in England, the heartsease and red clover would become very rare, or wholly disappear. The number of humble-bees in any district depends in a great measure upon the number of field-mice, which destroy their combs and nests; and Col. Newman, who has long attended to the habits of humble-bees, believes that "more than two-thirds of them are thus destroyed all over England." Now the number of mice is largely dependent, as every one knows, on the number of cats; and Col. Newman says, "Near villages and small towns I have found the nests of humble-bees more numerous than elsewhere, which I attribute to the number of cats that destroy the mice." Hence it is quite credible that the presence of a feline animal in large numbers in a district might determine, through the intervention first of mice and then of bees, the frequency of certain flowers in that district![1]

In examining the quoted passage, the first need is for a polite way of contradicting one hailed as practically infallible. However, we may say with respect to the assertion "Humble-bees alone visit red clover, as other bees cannot reach the nectar" that, as a whole, it involves a *non sequitur* and that the first part of it is untrue. The basis for these strictures will come out in discussion of the inclusive topic of the role of what in America are called "bumblebees" in pollinating heartsease (*Viola tricolor*) and red clover (*Trifolium pratense*). Darwin says: "We may infer as highly probable, that if the whole genus of humble-bees became extinct or very rare in England, the heartsease and red clover would become very rare, or wholly disappear." This statement ignores the fact that the smaller, paler-flowered forms of *V. tricolor* are regularly self-pollinated (letter from J. W. Dutton, Ministry of Agriculture, London, January 21, 1935) and that honeybees are active pollinators of *T. pratense*.

Experience with red-clover pollination in England, where honeybees are maintained in numbers, can scarcely differ from that in the United States. Here, in an investigation by the Colorado Experiment Station,

> Honeybees were found to be carrying red-clover pollen. A large percentage of the bees observed were active pollinators of red clover. These insects are a major factor in pollination of this plant in Colorado, east of the mountains. [The author adds]: The length of the corolla tube apparently has no bearing on red-clover pollination by honeybees.[2]

Federal Department of Agriculture authorities bear out the last remark, saying, "Honeybees visit red clover principally for pollen and seldom obtain nectar, but regard-

less of what is obtained, pollen is transferred and cross-pollination is effected."[3]

As a conclusive instance, Ohio investigators found during a three-year study of red-clover pollination "that more than four-fifths of the total pollination services was performed by honeybees" and recommended that clover-seed producers maintain as large a number of colonies of these bees as they profitably can.[4]

These quotations would seem to dispose of the claim that bumblebees are indispensable as pollinators of red clover. Even if they were, dependent parts of Darwin's argument do not follow. He refers to destruction of bumblebee nests by field mice, and of the mice by cats, and concludes: "Hence it is quite credible that the presence of a feline animal in large numbers in a district might determine, through the intervention first of mice, and then of bees, the frequency of certain flowers in that district!" He might as well have started the chain with old maids, as some innovators have, and then gone on to include the success of agriculture and possibly the fate of the nation, as red clover is a leading forage crop and heartsease a prime weed. Domestic cats certainly do not as a rule regulate the population of field mice; they prefer an easier way than that of making a living. American studies show that at least half the food of prowling cats consists of garbage. The role of field mice in destroying bee nests was in turn overestimated. The late Dr. T. H. Frison wrote me:

> I have called attention to the fact that queen bumblebees make extensive use of mice nests when founding colonies. I have good evidence that mice at times kill out some of these new colonies but I believe that any harm done to bumblebees by rodents is more than offset by the use that bumblebees make of the deserted nests of small mammals such as mice (Letter, March 7, 1935).

F. W. L. Sladen, a British authority who has much the same to say about the relations of field mice and bumblebees, further states:

> I cannot corroborate Col. Newman's statement, quoted by Darwin, that humblebees' nests are more numerous near small towns than in the open country, believed to be because the cats in towns keep down the field mice, and think this must be the case only in particular localities.[5]

Darwin's argument in this case thus does not stand up under the findings of later studies and does not deserve the wide circulation it has received.

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KOREAN SCIENTISTS ORGANIZE

By FRANK L. EVERSULL

Dr. Eversull (Ph.D., Yale, 1934) has been a clergyman and a college president. His mission in Korea was as Chief of Colleges and Teachers Colleges. In February of this year he returned to his home at Columbia, Ill., for a few weeks, or perhaps months, of writing and speaking.

PREAMBLE: In order that the scientists of Korea may have greater opportunities for scientific study and research, that scientific knowledge may be made more readily available to enrich and enhance the social, economic and industrial life of our nation, that we may cooperate in our efforts to spread the results of scientific research and study and that we may honor our great scientists, we do hereby adopt this Constitution and these Bylaws of the Korean Association for the Advancement of Science and the Korean Academy of Science."—From the adopted Constitution of the Korean Association for the Advancement of Science and the Korean Academy of Science.

WITH the beginning of a new day in Korea there is a distinct trend on the part of the leaders of that country to organize themselves for national advancement. With no group has that been more apparent than among the intellectual leaders. As the scholarly pursuits began to take form after the American occupation and as the leadership of the country began to assert itself, there was a growing disposition to study the problems of the new Korea and to take steps to promote those arts and sciences that were necessary for the growth and development of a new nation.

In August 1946 the Military Governor proclaimed Ordinance 102, which established the National University of Seoul. Its predecessors had been the Chosen Imperial University, a part of the Japanese educational system, and a number of public and privately owned colleges. These were merged into a great National University. Up to the time of the liberation these colleges had been staffed with Japanese professors. Then came the day of repatriation when the places of leadership were taken over by native Koreans. Many of these had been trained in the United States; many more had received their advanced degrees in one of the Japanese imperial universities. But in spite of the divergence of training and the differences in points of view they had one universal passion. That was the desire to know more about science and to be able to apply their findings to the problems of the nascent nation. It is little wonder that there was a growing feeling that the scientists should organize and that they should pool their resources to build a social and an economic order in Korea that would permit that nation to take its rightful place among the nations of the world. Everywhere professors met there was always one topic of conversation. That was atomic energy. Then they would bemoan the fact that for the past six years they had been deprived of the periodical literature and the scientific publications of the remainder of the world.

The library of the Seoul National University is particularly rich in the history and the literature of the Orient. It has been enriched on several occasions by lavish gifts from members of the Korean royal family and from other individuals. The Japanese had subscribed to most of the learned journals of the world. But with 1940 there came an end to all publications. The bound files ended with that date; the newspapers of the world ceased coming; new books were stopped by the war. Then came the days of combat, and the work of

the librarian became that of a warehouseman rather than that of a trained curator of books, papers, and magazines. After the liberation came chaos in the physical plants and the feeling of chaos in the minds of the new leaders. This was the situation in Korea when the American Military Government came into the country.

As soon as college faculties were organized and started to work there were discussions about the necessity for the organization of the scientists of Korea. This was also discussed by those interested in industry, commerce, and government. In fact, several small groups had organized to meet these demands. These new organizations clustered around personalities and within professions. They partook of the political ideology of the leaders and they were more or less mutually exclusive. Science was moving along personal and political lines, and there was a growing feeling of dissatisfaction about the trends. This became more and more evident as the scientists themselves called attention to the inadequacy of the growing practice. Old friendships were beginning to dominate the scene. The scientific specializations were being segregated. The problems of admission to one or another of the groups were being settled on the basis of friendship or political affiliation. Thus was chaos worse confounded.

Last December a small group met at the office of the Department of Education to discuss the whole problem and to seek information about the organization of scientists in the other countries of the world. I was asked to consider the organization of a scientific society in Korea and to write a proposed constitution and a set of by-laws for such an organization. The library of the Seoul National University was a veritable treasure house of materials on the scientific societies of the nations of the civilized world. This literature was canvassed, and out of the study there emerged a form of organization that was adapted to the needs of Korea and was fashioned to meet the psychology of the Koreans.

The final draft of the constitution provided for two organizations. One was the Korean Association for the Advancement of Science, patterned largely after the American Association for the Advancement of Science. Provisions were made for sections of the various sciences and for regional societies. The general administrative patterns were established. The second organization was the Korean Academy of Science. It was planned that this Academy should be the honor society for the proven scientists of the country. Membership was to be determined by the Academy itself after an initial group had been carefully selected by an Activating Committee. Membership in the Academy was limited to fifty or fewer members, to be elected for life. The new members were to be called upon for inaugural addresses in their fields of study and research. These lectures would provide the programs for the annual meetings of the Academy. An Executive Committee was created; its members consist of the President and the Vice-president of the Association, the Chancellor and the Vice-chancellor of the Academy, together with the Secretary General of the two groups.

On January 30, 1947, sixty-two of Korea's leading scientists met to form the Korean Association for the Advancement of Science in a large classroom of the Technical College of Seoul National University. It was a bitterly cold morning; the chilled seekers after knowledge huddled around a small Japanese wood-burning stove in the middle of the room. Occasionally an old, grizzled Korean came noisily into the room and added a few more sticks of precious wood to the fire. In addition, an *hibachi* stood on the presiding officer's desk. This is a large glazed vase, half full of ashes, in the center of which nestle a few embers of glowing

charcoal. The speaker and the presiding officer warmed their hands over these coals when the cold became intolerable. The bright points of fire served as good cigarette lighters, too, for matches are scarce and very costly in Korea.

Amid such scenes the Korean Association for the Advancement of Science and the Korean Academy of Science were born. I had been asked to speak on "Korean Science and Korean Scientists." The address was clearly translated, sentence by sentence, by Dr. Lee Tai Kyn, Dean of the College of Arts and Sciences of the National University. He is an able chemist and a graduate of the Imperial University of Japan. The opening address over, the men proceeded to organize. They elected Dean Lee as the temporary chairman and then the proposed constitution and by-laws were offered. There followed a general discussion, at which time a great number of questions were asked and answers given. The afternoon and most of the next day were spent in translating the document. The constitution and by-laws had been previously submitted to the Department of Justice of Military Government and to a number of interested scientists.

The remainder of the second day was spent in discussing the provisions of the constitution and the by-laws. As the cold night came on the group finally adopted their constitution and their by-laws. Five minor changes had been made in the original proposals.

On February 1, the Activating Committee met in the offices of the Department of Education. They proposed that the two new organizations be accredited by the Department of Education as the two national scientific societies. This plan was according to one of the changes made in the original draft. It was suggested in the proposed constitution that the bodies be chartered by the Legislature, which was then in session. The members reasoned that their procedure would be better since the Department of Education could obtain funds for the operation of the Association and the Academy from legislative appropriations. So, in the presence of the officials of the Department of Education, the accreditation was granted, and the Korean Association for the Advancement of Science and the Korean Academy of Science were sponsored and officially blessed as well as endowed. The Original Copy of the proposed constitution and by-laws has been presented to the American Association for the Advancement of Science for its archives.

Those in charge of the work in Korea will soon begin to correspond with American scientists and with the A.A.A.S. They are ready to undertake the rehabilitation of science in Korea and through this rebirth to bring Korea into a place of leadership in the scientific world.

POPULATIONAL CHARACTERISTICS OF AMERICAN SERVICEMEN IN WORLD WAR II

By MAPHEUS SMITH

Dr. Smith (Ph.D., Vanderbilt, 1931) first came to Washington in 1935, on leave from the University of Kansas, where he had been teaching sociology. He was then Research Analyst, Federal Emergency Relief Administration and Works Progress Administration. During the war he was in the Division of Research and Statistics, Selective Service System. He is now Assistant Chief of Records and Research, Office of Selective Service Records.

SEVERAL groups of specialists are interested in the age, race, occupational and industrial background, educational level, and marital-dependency status of American servicemen in World War II. For example, population specialists are interested in population composition studies of all kinds of groups, both per se, as well as for the light they shed on the present composition of the total population and their implications for future population composition, size, and quality. Industrial manpower specialists are interested in the impact of military mobilization on industrial manpower and productive capacity. Military manpower specialists need to know what effect the drain of mobilization has on the ability of the nation to equip and transport armed forces. They also need to know what further men could have been withdrawn from civilian life for use in the armed forces without weakening the nation's power to support military operations. Sociologists are indirectly concerned with populational characteristics of servicemen for all these reasons, but are more directly interested in the broader implications of the facts. For example, does military service tend to eliminate people with some characteristics more rapidly than others? Or, stated another way, does military service constitute a selective factor on the quality of the population? Sociologists also seek by a study of the effect of occupational selection and selection of men by marital status to gauge the effect of large military mobilization on social institutions and community organization.

The following sections review the available facts on the numbers and populational characteristics of more than 13,000,000 highly selected men, below the grade of commissioned officers, serving in the armed forces of the United States between 1940 and the surrender of Japan in September 1945. The available information is substantially but not entirely complete even for the inducted and enlisted men. Data on the Coast Guard, which was transferred from the Treasury Department to the Navy for the period of active fighting, are lacking, as is much of the information on the Marine Corps. Information on the Navy also does not cover as much of the emergency period as that on the Army. However, information is available on many of the characteristics of more than 95 percent of these men.

Racial distribution. Men of all racial groups composing the American population served in the armed forces, but whites were somewhat overrepresented in comparison with the general population. Race data, available on almost 13,000,000 inducted and enlisted men in the Army and Navy, exclusive of the Marine Corps and Coast Guard, reveal that 8.5 percent were Negroes, and all other races constituted 91.5 percent. Since 9.5 percent of all males eighteen through forty-four years of age in the national population in 1940 were

Negroes, this racial group was underrepresented. Although the percentage variation was small, the number of Negro servicemen was more than 130,000 less than their percentage in the general population would lead one to expect.

The only information available on minor races is on Army inductions. Such information reveals that about 0.5 percent of inducted men were Puerto Ricans, 0.3 percent were American Indians, 0.2 percent were Japanese, 0.2 percent Chinese, 0.1 percent Filipinos, and other races, chiefly Hawaiian and Mexican, were 0.3 percent. These figures agree very closely with those for the general male population eighteen through forty-four years of age. The only exceptions were American Indians, who were underrepresented, and the Chinese, who were overrepresented. The shortage of Indians was probably due to the overage of this group among volunteers, while the Chinese, not being accepted readily as volunteers, were overrepresented among inductions. Failure to accept large numbers of Negroes as volunteers during much of the war also was reflected in the overage of this race in inductions (11.2 percent of Army inductions, 9.5 percent of male population).

Age. As is true of the armed forces in all wars, the American serviceman of World War II was young. Men entering the Army and Navy averaged more than six years younger than all men in the country aged eighteen through forty-four in 1940. Younger men in this age range had entered service in disproportionately larger numbers and older men in disproportionately smaller numbers.

When the fighting ended almost half the men who had served were still under twenty-six years of age, 42.6 percent were between twenty-six and thirty-seven years of age, and 7.5 percent were thirty-eight years of age or over. In contrast, only 29 percent of the total male population were under twenty-six in 1940, 38.2 percent were twenty-six through thirty-seven years of age, and 32.8 percent were thirty-eight years of age or older. The comparative youth of those who entered the armed forces was the inevitable result of the fact that the armed forces restricted the acceptance of men above certain ages and established physical standards for acceptance that few older men could meet.

Analysis by individual year of age reveals that servicemen surpassed the general population in proportion in each group in each year of age from nineteen through thirty-one, but were surpassed in all age groups above thirty-one years.

The age characteristics of inducted and enlisted registrants of the white and Negro groups were generally the same as for the total group, except that Negroes were about half a year younger than whites, on the average. The main reason for this was that Negroes were not accepted in as large numbers during the early period of mobilization, when older men were accepted, as later, when the age range was reduced to obtain more young men for offensive warfare.

Civilian occupations. Manual workers, predominantly from cities, contributed a larger proportion of inducted and enlisted men to the armed forces than they constituted of the 1940 experienced male labor force, whereas professional, managerial, service, and agricultural workers were underrepresented in the ranks. Thirty-nine percent of all inducted and enlisted men reported a civilian occupation as operatives and laborers at a semiskilled or unskilled level at time of entrance into service. This proportion contrasted with only 31 percent in the experienced labor force of 1940. Another 14.2 percent of servicemen were craftsmen, foremen, and kindred workers of highest manual skill,

who constituted only 13 percent of the total experienced labor force in 1940. Servicemen whose civilian occupations were nonclassifiable, largely because they had no definite work experience or skills, constituted 8.1 percent of all servicemen, but only 1.4 percent of such persons were in the male labor force of 1940.

Professional and semiprofessional workers were 3.6 percent of servicemen, 5.2 percent of total male workers; managers and officials were 2.5 percent of servicemen and 7 percent of total male workers; clerks and sales workers were 12.2 percent of servicemen and 13.2 percent of the male labor force; service workers were 4.6 percent of servicemen and 6.4 percent of total workers; and farmers and farm laborers were 10.8 percent of servicemen and 17.8 percent of total male workers. In addition, 4.9 percent reported they were students at entry into service, compared with a number of male students above eighteen years of age in 1940 equivalent to 5 percent of all experienced male workers.

In interpreting these occupational data it is important to recognize that officers are not included, and these are drawn predominantly from among professional, semiprofessional, managerial, official, and clerical workers and students. Selective Service deferment policies also led to the retention of many professional, managerial, and agricultural workers in work necessary to the war effort. The differential for service workers is greatly affected by the large proportion of such men found physically unfit. This factor also affected agricultural workers to some extent.

Civilian industries. Information on the civilian industry of servicemen is much less complete than for occupation, but some general conclusions are possible. During the first year of the war and in comparison with the 1940 experienced male labor force, all industries were underrepresented among Selective Service registrants aged eighteen through thirty-seven years, except government employees and workers in industrial establishments not elsewhere classified. The underrepresentation was proportionately greater among agricultural workers than for any other industry group, and the causes were the same as those mentioned in connection with occupation. The other groups were underrepresented because of the very great differential for workers in establishments not elsewhere classified (16.9 percent for servicemen, only 2.6 percent for the 1940 male labor force). The unemployed were a major factor here, but there were many others whose industry was unclassifiable because of poor reporting.

Other industrial data for men inducted during the period November 1943–December 1944 reveal the effect of changes in the relative availability of different industry groups. In comparison with the 1940 male labor force, agricultural workers were less underrepresented and manufacturing workers were greatly overrepresented.

The distribution of last civilian occupation of servicemen was extremely variable from one industry to another. And this distribution also differed greatly from that of the 1940 male employed population of comparable ages. A considerably larger part of inducted males than of the total male population was from operatives in manufacturing (19.1 percent) and craftsmen in manufacturing (7.1 percent) than was true of the male employed population in 1940 (8.8 and 5.8 percent, respectively). On the other hand, a much smaller proportion of inducted than of total workers were employed as proprietors in all industries, professionals in service industries, craftsmen in construction and service industries, and service workers in service industries. The first three of these differences resulted largely from Selective Service occupational

deferment policies, and the last was greatly affected by the high physical rejection rate of service workers.

Marital status and dependency. As a rule, the armed forces have preferred to restrict their personnel to single men without dependents. This has been particularly true of recruitment for foreign wars and of men who are conscripted, because of the conflict of military life with family interests of married men and men with dependents. This selective policy was followed in World War II as long as possible, but the need for a very large military establishment and the necessity of having young men for combat, regardless of their dependency and marital status, combined to bring about the induction of many married men, fathers, and single men with collateral dependents.

More than 3,000,000 married men did serve among the enlisted and inducted personnel of the armed forces during the war, but they made up only 28 percent of all servicemen, in contrast with the 59 percent of the total male population aged eighteen through forty-four years who were married in 1940. Thus, less than half as large a number of all servicemen than of men in the total population were married.

Information on the proportion of divorced, separated, single, and widowed men is not available for those who served in the Navy, but such data for Army inductions reveal that 69.6 percent were single, 25 percent were married, 2.5 percent were separated, 2.4 percent were divorced, and 0.5 percent were widowed. Since corresponding figures for the total male population of comparable ages were single 38.9 percent, married 56.3 percent, separated 2.9 percent, divorced 1.1 percent, and widowed 0.8 percent, over 70 percent of the Army inductees were men without marriage ties at the time of induction, and 60 percent of all men of the same age were married, separated, or widowed.

The same general differential between the marital status of inducted soldiers and the total population is noted for each age group. The percentage of single men declined progressively from the nineteen-year-old youths (95.9 percent) through age thirty-four (46.4 percent) and age group thirty-five to thirty-nine (44.8 percent), but the difference between the percentage of single men in the service and general population increased steadily with increasing age. For age nineteen the difference was only 1 percent, for age twenty-five it was 26 percent, and for ages thirty-five to thirty-nine it was 29 percent. The percentage of married rose with age for both servicemen and all males; the proportion of married was consistently much lower for servicemen, and the difference increased with age. The percentage of widowed men was consistently smaller for servicemen in each age group than for the total male population, but was higher in the case of the divorced, in both cases increasing with age. In short, the differentials in marital status between servicemen and others increased in all categories with increasing age.

Information on combinations of marital and dependency status of servicemen is confined to Army inductees. A total of 13.7 percent of the unmarried registrants who were single, divorced, or widowed reported dependents at time of entering service (parent, sibling, or other); 61.3 percent were unmarried and without dependents; and 25 percent were married and had dependents. In comparison, only 30 percent of the total male population eighteen through forty-four years of age in 1940 were unmarried and without dependents, 9.4 percent were unmarried but reported dependents on the census schedule, and 60.6 percent were married. Since single men may have believed that they could avoid induction if they reported dependents, it is possible that the proportion of servicemen

who were unmarried with dependents is overstated somewhat. However, since Selective Service policy was to avoid as long as possible the induction of married men with bona fide dependents, it follows that after all eligible single men had been forwarded for induction the unmarried men with dependents would be the next group to go, and married men with dependents would be the last to be called up. Such a sequence of processing toward induction is indicated by the marital-dependency figures on induction and by the differentials between the figures for inducted servicemen and those for the total male population.

Education. World War II servicemen of all classes were above the national average in amount of schooling. A total of 56.8 percent of men inducted or enlisted in the Army and Navy had completed at least one year of high-school work, and 12.3 percent had completed at least one year of college work. The same proportion of the total male population eighteen through forty-four had completed one or more years of college, but only 40.6 percent of the total male population had finished one to four years of high school but less than one year of college. On the average, servicemen had one more year of schooling than the total male population.

The difference between the educational background of men serving in the armed forces and those in the total population was greater than this, however. In the first place, men inducted and enlisted in the Marine Corps and Coast Guard, not included in the data mentioned above, were more highly selected for schooling than the average of Army and Navy servicemen. In the second place, officers of all services are highly selected for educational qualifications. For example, Army officers completed one year of college, compared to one year of high school completed by those below the rank of officers. About 48 percent of the officers had completed one to four years of college, and almost one-sixth more had completed some graduate work.

Both Negro and white servicemen were selected on the basis of educational background. The educational status of white servicemen was above that for Negroes, but both white and Negro servicemen reported more schooling than the total male population of the respective races. Over 74 percent of white soldiers had completed at least one year of high school, compared with 56 percent of the total white male population aged eighteen through forty-four years in 1940. Forty-five percent of Negro servicemen had the same level of schooling, compared with only 21 percent of the total male Negro population of the same age group. Thus, although whites surpassed Negroes in educational status both among servicemen and the total male population, Negro servicemen had more education than the total white male population. Also, the differential between servicemen and total males was greater for Negroes than for whites, revealing a proportionately higher degree of selectivity for Negroes than for whites. Negro servicemen surpassed total Negro males by two school grades, on the average, compared with only one school grade for white servicemen compared with the total white males.

The superiority of educational background of servicemen over the total male population appeared in all age groups, but was somewhat greater among older than younger men. The superiority of servicemen was one school grade for men aged thirty-one to thirty-five and two grades for men thirty-six years of age and over. For youths under twenty-one years 79 percent of servicemen had completed one or more years of high school, compared with 67 percent of total males, and 74 percent of servicemen aged twenty-one to twenty-five years had completed one or more years of

high school, compared with 62 percent of total males.

Physical and mental status. The physical and mental status of servicemen was necessarily far above the average of the general population, since those with certain kinds and degrees of defects were rejected for service. It is true that servicemen were not all perfect physically, and for the greater part of the war period some men were accepted for limited military service. Such men had defects that prevented their use for general military service. The maximum of limited-service men that could be accepted was fixed at 10 percent of men inducted in any induction station on any day. Slightly less than 5 percent of all inducted men were actually below the standards for general military service.

The average inducted man had one recordable defect, which, however, was not of a kind or degree to cause his rejection. The rate for limited-service men was slightly less than two defects per man, compared with slightly less than one for general service inductees. The average rejected man was reported to have about 1.5 recordable defects serious enough in type or degree to be disqualifying.

Information on specific defects reveals some of the effects of military selection on the characteristics of the residual civilian population. The armed forces accepted men with certain defects of eyes, throat, nose, sinus, teeth, mouth, genitalia, feet, and skin, and with varicose veins, venereal disease, and weight deviation. This means that so far as these defects are concerned the civilian and military populations remained quite similar, and military selection did not materially alter the physical status of the total male population. On the other hand, as a result of rejection for any sort of military service, there was an increase in the residual civilian population's average incidence of tuberculosis, hernia, and hemorrhoids, and of ear, lung and pleura, cardiovascular, abdominal viscera, kidney and urinary, musculoskeletal, endocrine, and neurological defects, as well as of the incidence of mental disease and deficiency and infectious and parasitic diseases. The precise amount of effect selective factors had on the civilian population is not known, however, because not all the civilian male population of military age were given physical and mental examinations. Nor has information on the physical characteristics of enlisted men been summarized for comparison with the inducted men and the residual population.

Of those men who were inducted, about 35 percent were without recordable defects, a figure about twice as large as for the total examined and, it is believed, of the total male population of comparable age. All these men without recordable defects were inducted for general military service, whereas all men inducted for limited service had recordable defects, as did all rejected men. In view of the fact that possibly an even larger proportion of men who voluntarily enlisted were without recordable defects, the effect of the transfer of men from the civilian population into the armed forces necessarily greatly lowered the average physical and mental quality of the civilian population, so far as recordable defects indicate that quality.

State of residence. Because of the influence of the Selective Service System, the armed forces were recruited from each state in about the same proportion. Since more than 60 percent of all servicemen were inducted and these men were called from each state in proportion to the number of men already furnished by the state and also in proportion to the total registration of the state, the proportion of all servicemen from each state was approximately the same as the proportion of males of service age in that state. New York, the most populous state,

furnished the largest number of servicemen, followed, in order, by Pennsylvania, Illinois, California, Ohio, and Texas.

A few states furnished a significantly larger proportion of servicemen than they had of Selective Service registrants. The more populous and industrialized states of New York, Pennsylvania, California, Massachusetts, and New Jersey were outstanding in this respect, largely because of the influx of industrial workers from less-industrialized states where their registration records were retained. On the other hand, Alabama, Georgia, North Carolina, South Carolina, and Virginia were underrepresented among servicemen, because of losses through migration and because of high physical rejection rates and large proportions of agricultural workers.

THE inevitable effect on the civilian population of the withdrawal of men of military age was to make it overwhelmingly a feminine population, to leave it with a slightly larger proportion of nonwhites than before, to increase its average age and the average age of its males, to bring about the replacement of men in industry with boys, retired workers, women, and girls, to increase the percentage of the civilian male population who were married and who had dependents, and to lower the average educational and physical status of the civilian male population. Military withdrawals did not of themselves materially affect the migration or distribution of the male civilian population, but tended rather to reflect the changes resulting from expanded war industry and the recruitment of workers in parts of the country in which the greatest wartime industrial expansion occurred.

The temporary effect of these changes was great, but the period of military service of most of the servicemen was so short that the permanent effect of these withdrawals on the characteristics of the total population probably will not be very serious. Although casualties were heavy, the rapid demobilization of the armed forces enabled the civilian population to return quickly to its former general characteristics of sex, age, race, marital and dependency status, occupational and industrial characteristics, and educational status. War casualties increased slightly the proportion of the population with disabilities, but this is about the only change that will continue in effect for as much as a generation. The effect on marriage rates of the withdrawal of millions of young single men from civilian to military life is already being substantially erased by a record marriage rate in the early postwar period. The net effect of delayed marriages on the birth rate remains to be assessed, but it now seems likely that there will be no serious permanent effects of the war on the number or composition of the American population.

Book Reviews

TOWARD COSMIC ENERGY

The Evolution of Modern Physics. Carl Trueblood Chase. ix + 203 pp. $2.50. Van Nostrand. New York. 1947.

HARVARD UNIVERSITY announces that its president will teach a course in 'The Growth of the Experimental Sciences' in the University's new program of General Education." Great news! The scholar-president of a university will teach his undergraduates! The history of science comes into its own! Here and there the world moves forward!

Carl Trueblood Chase has recognized a sound principle for years—"a study of history is essential to a full understanding of the world we live in . . . especially true in the realm of science. . . ." Fifteen years ago he embodied the principle in *A History of Experimental Physics*. In the current year of grace, irradiated, ionized, radioactivated, and fissioned mankind will buy anything labeled "atomic, energetic, and modern." So Dr. Chase and his publishers have brought forth a popular model called *The Evolution of Modern Physics*.

The new model is well planned. Twenty chapters, each an act in a great drama, unfold the story of human knowledge from lodestone and amber days to the contemporary world of neptunium and plutonium, intruding neutrons and splitting atoms, darting photons and spinning electrons, ephemeral positrons and shadowy neutrinos. Each major character in the drama from Thales to Rutherford, and many a minor one, steps upon the stage, addresses his questions to Nature, hears and records her answers, and makes his exit, leaving to successors new knowledge, new concepts, new principles, new speculations, new ways of looking at the same old world. An urge toward unity and simplicity has moved all the great inquirers, and the spirit and trend of his times has prompted each to ask his particular questions at his appointed time. That evolution has been continuous and consistent is convincingly told by Dr. Chase. A reader who knows the outlines of political and social history and the rudiments of chemistry and physics will follow the book with sustained interest and profit.

One wishes that the entire text were written in language commensurate with the story that it tells. The first four chapters are overloaded with detail. Paragraphs become entangled. Sentences are heavy with words. Asides are frequent and often irrelevant. At the end of the fourth chapter the reviewer threw the book aside and turned for refreshment to *The Rise of Modern Physics*, by Henry Crew, a gentleman-scholar of the old school who knows physics and writes its history in terse, lucid, convincing English. Chase's later chapters, however, treat specific and limited developments in modern physics and are much better written. Altogether the book gives a vivid picture of physics during the past sixty years.

Perhaps ten years from now the author will bring his book up to date and will then reconsider his earlier chapters. And there are always available as models the writings of those great English-speaking scientists, those masters of the mother tongue such as Michael Faraday, John Tyndall, and Sir James Jeans.

The book is beautifully illustrated with

twelve full-page plates showing phenomena and equipment representative of modern physics.

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EASY WRITING'S CURST HARD READING

Writing Scientific Papers and Reports. W. Paul Jones. ix + 115 pp. $2.50. Wm. C. Brown. Dubuque, Iowa. 1946.

THE syllabus prepared by W. Paul Jones, Professor of English in Iowa State College, for use in an undergraduate course, is elementary, detailed, and practical. The author seems to know where young writers (and many older ones) need help.

In the first chapter Professor Jones makes scientific writing seem pretty noble. He says it presents facts, excludes unsupported opinions, does not exaggerate; it is accurate and truthful, disinterested, systematic, sincere; it is not emotive, argumentative, nor persuasive. He is too polite to say that some of it is bunk.

The elementary semantics in the next few chapters will help those who lack experience in writing. The processes of definition, classification, analysis, and description are outlined from the standpoint of one approaching them for the first time. Next come detailed suggestions for writing abstracts, short and long reports, and even book reviews.

To writers past college age, the last two chapters will probably be the most valuable in the book. Chapter XIV, which contains sound advice on abbreviation, punctuation, and like matters, will provide a useful "form sheet," or manual of typographical style, for many minor problems of technical writing. It should help eliminate blunders by the inexperienced and the forgetful. The last chapter treats with clarity and good sense more general topics of sentence structure and diction. Special attention is given to matters in which many writers need guidance—parallelism, antecedents of pronouns, dangling modifiers, wordiness.

Because this classroom syllabus is detailed and has numerous examples and exercises, it should be suitable also for self-instruction. I think that engineers, researchers, and others who try to do technical writing without special training could profit by studying it.

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THE LITERATURE OF PROPAGANDA

Mass Persuasion: The Social Psychology of a War Bond Drive. Robert K. Merton. 210 pp. $2.75. Harper. New York. 1946.

AN analysis is made of the content and techniques utilized by Kate Smith in a radio war bond drive, together with the results of interviews concerning the broadcast with over a thousand people. Appeals are examined as to themes used and content avoided. Effects on listeners are related to their prevailing states of mind on the kindred subjects of patriotism and war bonds. A brief concluding chapter sums up the implications of the findings from a social point of view.

The results reported in this book are a worth-while addition to the literature of propaganda and are based on an interesting technique for its study. Organization of discussion is not always clear, and many of the sectional headings are confusing or even misleading. On the whole, however, the book should prove interesting and useful to students of public opinion, as well as to others interested in its implications.

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PROGRESS AND POVERTY

Trinidad Village. Melville J. Herskovits and Frances S. Herskovits. vii + 315 + xxv pp. $4.75. Knopf. New York. 1947.

THIS book should have a wide audience among scientists and laymen interested in better understanding the nature of culture and culture change in general, and of Negro culture in particular. The authors are a well-known team of American anthropologists who have had considerable firsthand experience in studying Negro culture in Africa, South America, the Caribbean, and the United States. One of their major interests has been the study of the diffusion of African culture and the modifications it has undergone in various parts of the New World.

This book, based upon one summer's field work in 1939, gives us the first systematic description and analysis of the culture of a rural Negro community in the English-speaking portion of the Caribbean. The setting of the book is the village of Toco in the far northeastern part of the island of Trinidad. The authors describe the village structure, the problems of making a living, the marriage customs, family life, magic, and religion. The final chapter deals with an analysis of the retentions and reinterpretations of African customs and beliefs in Toco.

The description of the village of Toco reveals a picture of poverty and backwardness characteristic of colonial peoples almost everywhere. The village has no electric lights, no running water, no sewage system. Most of the people live close to a bare subsistence level, earning their living from a combination of gardening, fishing, hunting, and seasonal labor on nearby cocoa and copra plantations. Less than half the families own their own land. There is practically no self-government, and political control is in the hands of whites who represent the British government.

In Toco, as in other Negro communities of the New World, women play a very important role in the social, economic, and religious life of the community. The authors are careful to explain that this is not simply a direct carry-over of African tradition, but rather a consequence of the unequal effect of slavery upon the lives of men and women. In the breakdown of native African culture during slavery, those institutions in which men were paramount, such as the patrilineal sibs and the complex political and governmental structure, were smashed. But women retained much of their traditional importance in family life and the rearing of children. It was, therefore, the women who played the key role in the transmission of the African cultural heritage.

Among the many interesting examples given by the authors of the survival and reinterpretation of African customs and beliefs are the following: the persistence of African food and eating habits; a form of cooperative labor among the men known as *gayap;* the belief that irate ancestors will punish abortion by barrenness; the importance of divination and the role played by the spirits of the dead; obtaining the approval of the ancestors for marriages.

> Toco culture corroborates the findings of New World Negro cultures everywhere that Africanisms have persisted more in the religious life of the people than in any other, save only folklore and music which were favored by the indifference of the slave-owner to their continuing expression. [The authors describe the cult of the Shouters in great detail and show that] . . . this sect represents a point of transition between African religion represented in Trinidad by the Shango cult, and undiluted European forms of worship, as found in the Church of England, among the Moravians, and to a lesser extent, the Seventh Day Adventists and the Baptists.

Despite the persistence of Africanisms, the Negroes of Trinidad, like those of our South, are not especially concerned with the question of the African origin of their culture. They have a passionate desire to

achieve the higher standard of living of the whites and look to education as one of the principal means of improving their situation. Many an illiterate Negro makes sacrifices that his children may learn to read and write.

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NATURALISTS OBSERVE—

The Mammals of Virginia. John Wendell Bailey. xvi + 416 pp. Illus. $5.00. Williams Printing. Richmond, Va. 1946.

Mammals of California. Lloyd Glenn Ingles. xix + 258 pp. Illus. $4.00. Stanford. Stanford University, Calif. 1947.

Mammals of Eastern Asia. C. H. H. Tate. xiv + 366 pp. Illus. $4.00. Macmillan. New York. 1947.

THIS painstaking, well-written account, illustrated with photographs and drawings, of the one hundred and thirty different mammals living in Virginia, including domesticated ones and a list of the fossils, is the result of many years' study and observation on the part of its author, a professor and head of the Department of Biology in the University of Virginia.

The general description of the Commonwealth of Virginia and its life regions, with a history of the published studies of Virginia mammals, amounts to a short monograph on the state itself, with much historical material. A classified list of the mammals is followed by a key to the families, and then for each species is given a diagnostic description, its distribution in the state, and its habits when known.

Even the different races of humans are classified and a population census given for each. There is a chapter on the economic importance of the various mammals, one on conservation, and a short chapter on the geological history, illustrated with a time chart. There is an extensive bibliography and a good index.

This thoroughly comprehensive and interesting work will be of much value to laymen, students, and naturalists.

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NO EQUIVALENT area in the world has at the same time so diverse a mammalian fauna and so complete a documentation of it in the form of specimens and published literature as has the state of California. The very magnitude of the task seems to have discouraged two generations of mammalogists from organizing the readily available data into a much-needed comprehensive treatise on the mammals of that state. It is certain, therefore, that the appearance now of a book entitled *Mammals of California* will attract the immediate attention of most American mammalogists.

Those who expect to find here a precise, detailed, and thoroughly documented work similar to Hall's recent *Mammals of Nevada* will be disappointed, but to the large body of amateur naturalists, teachers of biology in high schools and junior colleges, and beginning students of mammalogy this book should be a most welcome contribution. By arbitrarily eliminating all details of taxonomy and geographic distribution as well as all citations to published sources of information, the author has achieved a readable and unencumbered series of descriptive accounts of representative species of Californian mammals. Unfortunately, this same process of simplification has produced an appearance of superficiality, which does an injustice to Dr. Ingles' knowledge of his subject.

The book is essentially a compilation; those who are already familiar with the literature will recognize and know the sources of most of the distribution maps and

many of the items of natural history that are incorporated into the accounts. The author's original contributions, which, in view of his considerable field experience, must be numerous, are anonymously buried in the mass of compiled data. It seems unfortunate that a book professing to be written for the benefit of beginners in the field of mammalogy should fail to have even a condensed bibliography that would guide students into more advanced phases of the science.

Subspecies and all the problems of intraspecific geographic variation, which play so prominent a part in most studies of Western mammals, are strictly avoided. The ultimate unit in this book is the species. Keys based on geographic range, habitat, size, and similar superficial characters are provided for all the species of land mammals. A representative species in each genus is alloted a descriptive natural-history account. Among the bats, however, one species is allowed to represent the entire order; the popular appeal of bats to the amateur mammalogist seems to have been badly underestimated. The very cursory treatment of cetaceans is more readily understandable in a book of this sort. A tabular list of the species of Californian mammals provides a more balanced picture of the fauna, but here the taxonomically backward genera, such as *Dipodomys* with fourteen species, seem to overwhelm the more thoroughly worked ones, such as *Thomomys* with only four. A brief description of the process of preparing study skins is a commendable feature.

The half-tone reproductions are by far the most valuable part of the book. Most of them are from photographs made by the author, of living animals, and they give ample evidence of Dr. Ingles' skill as a photographer of mammals. The portraits of even such familiar subjects as black-tailed deer are a pleasure to study because of their arresting freshness and clarity of detail. The line drawings in general are inferior, and they include at least two incredible errors: kangaroo rat tracks are shown with five, instead of four, toe marks for each hind foot; and an asserted gray fox skull was obviously drawn from a red fox model.

As an attractively arranged guide for beginners, this book excels any other that has been published on the mammals of the Pacific Coast states. Those who attempt to use it as a manual or source book will be baffled by the extreme censorship of technical detail.

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THIS book is one of the "Pacific World Series" being published under the auspices of the American Committee for International Wild Life Protection and representing a thoroughly praiseworthy objective—to make readily available reliable information concerning the natural history of the vast Pacific region, which as a result of the war has definitely "come up in the world" in popular interest. Thus far the series has included works on Pacific mammals, insects, reptiles, plants, fishes and shells, and native peoples, as well as a book on *The Pacific World* in general. The geographical scope of the present number "covers some 6,000 miles of the Pacific coast of Asia, from northeastern Siberia through Manchuria, China, Burma and Indo-China, to the Malay Peninsula. The mammals of Sakhalin, Japan, and Formosa are included."

Dr. Tate's book is aimed at the reader who wants general facts rather than technical matters of mammalogy—the G. I., for instance, who wonders what that little animal was that he saw along the Burma Road. Scientific lingo is kept to the minimum, though Latin names had to be used for proper identification. Following two

short discussions, one defining what a mammal is and the other summarizing the geographical features and faunal areas of eastern Asia, the book takes up the various mammals group by group and species by species in systematic order (beginning with the insectivores and ending with the odd-toed ungulates). The larger groups (orders, families, and subfamilies) are characterized briefly, followed by the descriptions of the various species and forms. The descriptions average about half a page each and include distinguishing characteristics, details of size, color, etc., some idea of the range and habitat, and the animal's relation to other members of its group. The accounts seem well condensed and adequate for purposes of this book. Seventy-nine line drawings, including three maps, illustrate the text.

Since this is a volume of the handbook type, and hence likely to receive long, hard reference usage, it is a pity that the publishers were so skimpy in its manufacture. The binding is cheap and flimsy, inferior to that of many a dollar reprint; and the book is priced at $4.00! It seems to me that the hard and exact work put into the contents of this volume by Dr. Tate and his associates at the American Museum deserves a finer and more durable encasement.

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GLADLY WOLDE HE LERNE, AND GLADLY TECHE

On Understanding Science. James B. Conant. xv + 146 pp. Illus. $2.00. Yale. New Haven. 1947.

THIS little volume is an interesting, and probably important, trial balloon, dealing with the problem of "how we can in our colleges give a better understanding of science to those of our graduates who are to be lawyers, writers, teachers, politicians, public servants, and businessmen" (p. 1). Dr. Conant thinks that this can be achieved most effectively and economically by a lecture course in the history of science. Such a demonstration lecture course was given at Yale University by Dr. Conant. The present volume represents the illustrative material of these lectures. The four chapters, or lectures, deal with the scientific education of laymen; illustrations of scientific advances from the seventeenth century "touching the spring of the air;" illustrations from the eighteenth century concerning electricity and combustion; and certain principles of the tactics and strategy of science, that is, a more specific discussion of *the universal scientific method.* The reader will note that all the examples selected to illustrate scientific procedures and scientific discoveries are from the physical science fields. In any course on the history of scientific discovery and scientific advance, the selection of illustrative examples will, of course, vary with the teacher's own special field and special competence. Every field of science provides classical examples.

Such lecture courses in the history of science, such books on well-selected epics of scientific discoveries, will interest all informed adult citizens, scientists and nonscientists. The "$64 question" before us is just this: *Can such lecture courses or such books adequately impart the scientific method to people with no more factual contact with science?* Being a real scientist, Dr. Conant is not dogmatic on this point. He says (p. 17): "What I propose represents a tremendous extrapolation from any educational experiments of which I am aware. . . . I may be peddling a rope of sand." We shall not have the answer till we make the controlled experiment. On the basis of my own experience and observations, I believe that a minimum core of individual laboratory or field work is necessary for an implantation of the scientific method in the human grain,

an implantation that will effectively contribute to the person's understanding, thinking, and behavior. In my humble opinion, anything less than that may interest and amuse laymen, but it will not significantly reduce the present scientific illiteracy.

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REMEMBRANCE OF THINGS PAST

Fragments of Entomological History. Part II. Herbert Osborn. vii+233 pp. Illus. $2.75. Spahr & Glenn. Columbus, Ohio. 1946.

THE subject matter of this little volume, as its title indicates, is highly fragmentary and informal in character. It is presented by its author as supplementary to a volume bearing the same title published in 1937. The contents of this and of the previous volume were written bit by bit over a period of several years, and both were published largely as originally written, without full rechecking, or bringing all data down to date of publication. The author is a well-known dean of American entomology, now in his ninety-first year, who has long since attained world-wide distinction in his chosen field as scientist and educator.

As would be expected, the subject subdivisions of this second volume consist largely of a continuation of the same kind of material and of the same type of treatment as given in the earlier book. It comprises further consideration of the development of Federal, state, and commercial organizations in insect research and control, college instruction in entomology, entomological societies and congresses, periodical publications, journals of societies, and entomological books and monographs published during the past decade. A considerable portion of the book is devoted to highly informal sketches, old letters, and reminiscences of a biographical character concerning past fellow-workers and living colleagues. Because of the author's acquaintance with many of them, this portion of the work possesses particular interest.

Consideration also has been given to various commemorative events and memorials over the years, notably the Seventy-fifth Anniversary of the Entomological Society of Ontario, the Thomas Say monument, the Rafinesque Memorial, and the Anniversary Meeting for the half-century of the American Association of Economic Entomologists. Appropriate attention also has been given to growth and development of present-day buildings and equipment for entomological work, and to spraying, dusting, and fumigation appliances and the status of the insecticide industry.

During his long career the author of this book trained many of today's leaders in economic entomology, and they with his many other students and colleagues over the years hold for him a veneration, loyalty, and affection so unusual—so nearly unique in character—that it becomes a matter of extreme difficulty for any of his contemporaries, as in the present instance, to attempt critically or impersonally to evaluate any productions of his authorship.

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MOST PUNCTUAL MIRACLE

Spring in Washington. Louis J. Halle, Jr. 227 pp. Illus. $3.75. Sloane Associates. New York. 1947.

TOO few of the thousands of government bees who swarm, at the appointed times, in and out of their stone hives along Constitution Avenue ever see, much less understand, the events taking place in the natural world about them. Mr. Halle is not one of these. Although a busy assistant division chief in the complicated business of running the United States government,

he finds time to escape from the stuffy doings of the hive to ride his bicycle down the long straight pathway of Hains Point. Using his coat as a sail, free before the wind like the swooping gulls about him, he pedals back in the teeth of a brisk March wind, with lungs and eyes refreshed for a day's work.

Another morning Halle cycles down Rock Creek Parkway by starlight to Potomac Parkway, south along the Potomac River to Lincoln Memorial Bridge, across to Virginia through the early morning mists, and then southward again along Memorial Highway to Roaches Run lagoon, where, as the sun rises, the distinctive markings of each species of waterfowl become visible. The myriad phases of the oncoming dawn are his to enjoy, and he describes them beautifully in his book, with many appropriate allusions to the classics.

On certain mornings, when the feel of spring is particularly strong in the air, the cyclist pursues his pedaling with more energy than usual and finds himself speeding ever southward as if to meet the northward rushing spring and its wave of bird migrants. At Dyke, well down the Potomac beyond Alexandria, on the way to Mount Vernon, the electrifying song of the first warbler of the year halts him in mid-stride. Only the initiated know that quickening of the pulse the arrival of the gaudy, restless, migrant warblers produces in a bird-watcher. It is all the stimulus needed to pour new energy into tired muscles and drive the observer on to possibly new and unexpected finds. The author responds to these stimuli like the real naturalist he is, and the cold, muddy March waters of the Dyke marshes do not deter him as he wades knee-deep through them, his mind absorbed with the excitement of the sight of wheeling teal and yellowlegs above his head and the bittern that bursts from the reeds beneath his feet.

Halle is one of those who rebel at man's continual effort to harness and formalize nature and bend natural processes to his will. He gets spiritual satisfaction from the thought that, although the forces of nature may be guided temporarily by man, they are never diverted from their ultimate purpose. Like the tiny wild violet he saw springing up in a crack in the pavement, nature is ever alert to find an opening in the armor of artificiality. As if knowing that civilizations are always temporary, she waits patiently for an opportunity to throw her shock troops into any breach, eventually reclaiming the land from man with wave after wave of ecological succession. Halle takes pride in exposure of his body to the chill winds and icy waters of early spring; in satisfying his thirst when and where he pleases, even with swamp water, like the Indian or the fox; in being able to live in harmony with the irresistible forces of nature. This adaptability to the natural environment gives him an exhilarating sense of freedom from the regimentation of the human hive.

Yes, any Washington naturalist would admit after reading Halle's book that the author is one of the fraternity. His observations are keen, and his interpretations are intelligent, anchored to the firm foundation of a good knowledge of the literature. An occasional lapse, such as considering the sedentary, permanent-resident red-bellied woodpecker as one of the early migrants into Washington, together with the towhee, which actually is a migrant (although some few individuals winter here), is not serious. Such slight misinterpretations of his observations are certainly excusable in view of the complexity of the subject. Halle has given us a delightfully written and remarkably accurate description and interpretation of the natural surroundings of our legislators and other national leaders and the capital's teeming hordes of clerical workers. The charming black-and-white sketches by Francis L. Jaques of scenes well known and

beloved by Washingtonians add greatly to the enjoyment of the book.

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FROM MURMANSK TO VLADIVOSTOK

The U. S. S. R., A Geographical Survey. James S. Gregory and D. W. Shave. 636 pp. Illus. $4.25. Wiley. New York. 1946.

THE Soviet Union occupies one-sixth of the land surface of the globe and, with the exception of the British Empire, which does not constitute a single continuous mass of land, is the largest state in the world.... When it is realized that the U. S. S. R. produces more peat, sugar beets, flax [one might add also wheat, rye, oats, and barley], manganese, locomotives, railway-wagons, and agricultural machinery than any other state in the world, and more oil, machinery, agricultural machinery, motor lorries, tractors, iron and copper ore, gold, and superphosphates than any country in Europe, as well as occupying a high place in the output of coal, electricity, iron, steel, chemicals, and cotton, it is obvious that the last twenty-five years have seen the transformation of a formerly backward agrarian country into one of the world's leading industrial nations.... More significant than the phenomenal growth of industry, however, is its geographical redistribution.... The Soviet Union has added to the revived and reconstructed industrial centres of European Russia a powerful new industrial axis which extends eastward from the Urals, through Western Siberia and Irkutsk to Komsomolsk, Khabarovsk, and Vladivostok.... It must be remembered, however, that the output *per head of population*, of agricultural and industrial products had not reached that of the U. S. A. and Great Britain in 1939.

The above quotations from the last chapter indicate something of the flavor of this book and of the strength and importance of the Soviet Union.

This work provides the most detailed and up-to-date factual background on the geography of the Soviet Union available in English. About half the space is devoted to the systematic treatment of the terrain, climate, soils, natural vegetation, historical development, nationalities, agricultural and industrial development, transportation, trade, and population of the Soviet Union as a whole and its place as a world power. The other half is devoted to a consideration of the score or so major regions of the Union; this regional part is particularly valuable as the most extensive treatment of the regions of the U. S. S. R. available in any of the Western European languages.

The book is strong in its detailed recent information based largely on original Russian sources not readily available in this country, its 72 helpful maps and diagrams, and its surprisingly full index, which facilitates checking information on little-known places.

The book is poor in its treatment of place names, which are variously and sometimes quite erroneously spelled; since the American printing was reproduced photographically from the English edition, it was not possible to improve the book in this regard. Some readers will doubtless feel that the book moves too quickly into detailed description without sufficient introductory material, sufficient high-lighting of the more significant features of the land and the people, or an adequate critical appraisal of the relative success of the various Soviet programs for developing and transforming the country into a major industrial and military power with a planned economy.

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TIME WAS OF THE ESSENCE

German Research in World War II. Leslie E. Simon. xi + 218 pp. Illus. $4.00. Wiley. New York. 1947.

WHEN considered in the light of present-day threats of cutbacks in funds to continue research of military nature, this book is very timely. It is unfortunate, however, that the author did not extend the scope of the book by col-

laboration with scientists in other fields so that his title would be truly descriptive of the content.

The most serious omissions are in the fields of electronics, including radar, beacon, remote control countermeasures, etc., nuclear physics and the atomic bomb, and chemistry, which fields are not mentioned except in a few cases where demanded by their direct relation to ordnance.

Considerable space is devoted to an attempt to clear up the "currently ill-defined" terminology of research that is likely to leave the reader confused, especially with regard to "basic" research and "pure" research. Furthermore, throughout the book the author never quite makes clear whether he is at the moment speaking of research in general, military research, or the more restricted category of strictly ordnance research. He states in the foreword that he is going to "judge coldly" the completed experiments of German weapons research and, again, he assures the reader that he does not intend to compare the scientific accomplishments of Germany and the United States. However, he repeatedly inserts a soothing statement to the effect that the United States was doing, or did, equal or better work on almost every point.

It is true that Germany was not so advanced on radar (particularly microwave) and the atomic bomb as the United States, but it is also true that this can be attributed to the small amount of emphasis permitted on these projects. Colonel Simon has a tendency to underrate the magnitude of the German war research and its accomplishments. The work on guided missiles was vastly more extensive than, and well in advance of, similar work in the United States during the same period. This tendency to underrate the threat implied in the tremendous scale of German military research somewhat weakens the justifiable argument in the closing chapter, where the author emphasizes the importance of research for national defense during peace in order to accumulate a fund of knowledge to improve the quality of development during war, which inevitably forces more development and less research.

The summary of the more important ordnance research and development in interior and terminal ballistics, exterior ballistics and fire control, aerodynamics, and instruments and measurement techniques is well written and should prove interesting both to the scientist and the general public. An excellent organizational description of German war research agencies, together with a valuable analysis of the conduct of ordnance research, is presented. The author points out the lack of coordination between research and the military, which weakness in the German system greatly reduced the effectiveness of the research program.

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WARTIME NECESSITY

Buna Rubber. The Birth of an Industry. Frank A. Howard. xii + 307 pp. $3.75. Van Nostrand. New York. 1947.

THE current active discussion regarding the future of the American synthetic rubber industry makes particularly timely any book which throws light on the origin of that industry. As principal executive between 1919 and 1945 in the subsidiary of the Standard Oil Company (N. J.) engaged in research and development, Mr. Howard was an active participant in most of the events leading to the establishment of the government-owned industry set up in 1942 and 1943 to supply America's desperately needed rubber requirements. In this book Mr. Howard describes his part in these

events in straightforward historical fashion, maintaining a highly objective attitude and documenting many of his statements in a 52-page appendix of contracts, letters, and memoranda.

The book opens with a detailed description of the relations between the German I.G.Farbenindustrie and the Standard Oil Company, initiated in 1926 and continued until the time of the Hague agreements of September 1939. The titles of some of the chapters indicate the events covered: The Munitions Board, Europe Falls, The Advisory Commission, The Problem Comes to R.F.C., Indecision, Laying the Foundations, Establishing Industrial Cooperation, Setting the War Program, Controversy, Confusion (one of the best chapters), The Baruch Committee, and The Rubber Director. The detailed treatment ends in 1943 as the plants began to come into production.

Our relative inability to take effective action toward synthetic rubber production in the critical years 1940–41 was in line with much of the spirit of the times. One important factor, for example, was the unwillingness of both industrial firms and the government to assume the necessary financial risks. The goal of production was cut by steps from 100,000 tons down to about 2,500 tons and finally brought back to about 40,000 tons. There was an unexplained period of complete inaction from January to May 1941. A limited amount of promised government support for large-scale butadiene production was cancelled as late as September 1941. The necessary impetus to definite decisions and cooperative effort was supplied by Pearl Harbor and our entrance into the war. After that time the program moved along rapidly.

Anyone concerned with synthetic rubber can gain from this well-written and interesting book an excellent insight into the origin of the industry. With the enactment of legislation for a permanent national rubber policy now on the agenda of Congress, its members might profitably consider the future implications of the events described by Mr. Howard.

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RIVALING THE SILKWORM

The New Fibers. Joseph V. Sherman and Signe Lidfelt Sherman. x + 534 pp. Illus. $5.00. Van Nostrand. New York. 1946.

THIS book is a valuable contribution in that it brings together in one place information dealing with textile applications of many of the newer resins, both synthetic and semisynthetic. The first 374 pages consist of a detailed discussion of the various types of synthetic fibers now manufactured. The remainder is devoted to a bibliography of American patents in this field.

After a brief introduction, an important chapter compares significant physical properties of the better-known synthetic and semisynthetic fibers. Photomicrographs illustrate differences among nylon, "Vinyon," "Aralac," viscose rayon, acetate rayon, and "Fortisan." Specific gravity, tenacity, extensibility, recovery on unloading, stiffness, toughness, and several other physical properties are discussed. An interesting table of prices is included. Subsequent chapters are devoted to detailed consideration of the development, chemical nature, properties and applications of nylon, Vinyon, polyvinylidene chloride, "Fiberglas," polyethylene, various protein fibers, and the different types of rayon.

A number of materials that are at the present time only in the developmental stage are also mentioned. The discussion of protein fibers is particularly valuable and covers not only casein and soybean protein, but also fibers made from peanut protein,

zein, and chicken feathers. The chapter on new cellulosic fibers includes a review of Fortisan as well as of other less well-known materials.

To find a book whose preface is dated September 1946 bearing notations about elastic nylon, "Vinyon N," "Fiber A," and polytetrafluoroethylene fibers is gratifying and indicates the extent to which the authors have gone to make it up to date. It is also noteworthy that, among the 174 literature references given at the end of the various chapters of the text proper, only one is dated earlier than 1940.

A very interesting chapter deals with the economic aspects of rayon, now second only to cotton in commercial importance. New industrial uses of rayon, especially in tire fabrics, consumption of rayon by trades, price and production statistics for rayon made by the various processes, tables of production capacity by company, plant locations, consumption of cellulose according to type, and discussion of the effect of rayon on the demand for cotton, wool, and silk, paint a striking picture of the position of rayon in the economic life of the nation today. As a logical conclusion to this discussion export markets are considered.

A brief chapter deals with chemical treatments of textiles. The information in this chapter is of interest as far as it goes. It is perhaps unfortunate that emphasis has been placed almost entirely on resin treatments. This field is of course of great importance and is becoming increasingly significant. The fact should not be overlooked, however, that many nonresinous chemicals are used in large volumes in the finishing of textiles to give them numerous specific effects. It is to be hoped that a new edition of this book may see an expansion of this chapter to include other textile-finishing agents which, although less widely advertised than some of the resins, have nonetheless been developed during the past ten or fifteen years and are of vital importance to the textile industry today.

The authors have done an excellent piece of work in presenting a readable discussion of their subject, which should prove of value to the research worker. Much of it should also appeal to those laymen who possess a smattering of technical knowledge. Although the book bears some evidence of hasty assembly, this appears to be an almost necessary corollary of its valuable aspect of up-to-the-minute evaluation of recent fiber technology. Such criticism is hardly justifiable if too great emphasis is not laid on the word "fully" in the publisher's enthusiastic statement that it "describes fully the research efforts now being carried on to develop both . . . manmade fibers and the chemically improved natural fibers."

Both the authors and the publishers are to be congratulated on the very satisfactory make-up and pleasing appearance of this volume.

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Comments and Criticisms

ON THE NATURE OF ENTITIES

In the February 1947 issue of SM there appeared an article by Mr. Thomson King, entitled "On Life as a Separate Entity." Without wishing to subject Mr. King to unnecessary abuse, nevertheless I shall undertake to point out certain forms of logical confusion in his argument.

The fact of the matter is that not all questions are meaningful. Thus, if you should ask, "What time is it on the sun?" I would reply, "The question is meaningless." In effect, this is to say that things as they are may not be described in the terms used.

Before we can seriously consider any hypothesis whatsoever, we must show that we have not mistaken the form of Indo-European grammar for the structure of the universe. It does not happen—the common-sense belief to the contrary notwithstanding—that we observe, then think, then express our ideas. As Sapir puts it: "... the 'real world' is to a large extent built up on the language habits of the group. We see and hear and otherwise experience very largely as we do because the language habits of our community predispose certain choices of interpretation." We do not see things as they are, but through a form of representation. And if our system of concepts is unsuited to our problems, there is no possibility that these problems will be solved.

Fortunately, it is not difficult to ascertain whether a given system is adequate. Any logicomathematical system whatever specifies a set of elements and a set of symbolic operations. Such systems in and of themselves have no necessary application to the empirical world. We can at will construct an indefinite number of logical systems as well as an indefinite number of mathematics. Hence, it is unreasonable to assert that any sort of logical manipulation can in itself demonstrate or refute an empirical proposition. But if we have at hand things as they are, it is no great matter to compare them with a suggested system and thus perceive the existence or absence of correspondence in structure.

Thus, when someone asserts that life is a separate entity, we would ask (as politely as possible) what he means by "entity," what he means by "life," and whether he asserts that the epsilon relationship exists.

If—as in the case of Mr. King—he is unable to specify the necessary and sufficient conditions for membership in the classes he purports to establish, we say that he has failed to attach a meaning to his terms. After the manner of Wittgenstein, we show this lack of meaning in a simple way. Concerning the symbol "life," on Mr. King's list of attributes, the virus both has life and does not have life. As we have shown, when we find a thing that does not fit into our system of concepts, the system is without question inadequate. In such a case it becomes possible to formulate a *verbal* contradiction in the old system, which can be shown to be no contradiction in the new. (The classical example of this situation is the explanation of the "contradiction" between the Michelson-Morley experiment and the constant velocity of light.)

The meaninglessness of the term entity is even clearer. Mr. King has asserted that by "reason" he has proved that there must be either two or three entities in the entire universe. If we ask what he means by entity, he says clearly: "By entity we mean something having reality in fact, which is separate and unique in itself." Thus, we have six entities: ..... and the proof of Mr. King is shown to be untenable.

The reader may consider that we jest, but we do not. Does not each one of these dots have reality in fact? Is not each one separate? Is not each one unique in itself? Then, on the definition of Mr. King, they are entities, and his proof must be illogical.

We can also show this directly by means of formal logic. Postulating the applicability of the two-valued logic, we consider the two hypotheses of which he asserts one must be true:

A: There are two entities, matter and life.

B: There are three entities: matter, life, and energy.

Formally:

1) "Either A or B but not both" is a tautology if, and only if, A is "not B."

2) A is not "not B."

3) Therefore "either A or B but not both" may be false. Thus it is obvious enough that there may be any number of entities and that we have worked no logical miracle in producing six of them.

The attention of the reader is drawn to the manner of approach. If we had sought to show that Mr. King was in error by the abstract manipulation of symbols, we should have found ourselves forced to abstractions of higher and higher order. But by taking a simple case to which the defined terms

apply, we can in short order show that the subject is talking nonsense.

DONALD B. CREECY, JR.

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IS LIFE A DREAM?

Far below the level of mind, where Mr. King finds it hard to imagine that the addition of life to matter-energy has not introduced something qualitatively different, we may detect the beginnings of the marvelous transformation that takes place when lifeless matter becomes alive. It is the transformation from passivity to activity, from indifference to interest; in short, with the birth of life comes also the birth of values.

What a living thing does is good or bad; and, if it does not do right, it ceases to live. Furthermore, it evaluates its environment; it chooses what it will have, whether of matter or energy, and rejects the other. We may say that the amoeba has conduct; we could never say that of a stone. It has an object in life—to fill the world with amoebae—and it pursues that object.

We may even say that the "primordial protoplasma globule" that first received the spark of life, immediately upon that endowment, began to seek truth. A change occurred in its environment. That change was of moment to it. It called for a reaction. Unless that reaction was correct, true to the meaning of the change, a wrong adjustment would be made. We possess the truth when we foresee consequences.

Since it would be only nonsense to speak of lifeless things in this way, it seems to me Mr. King is on firm ground; but, of course, the mechanists call for proof, and we haven't got it. Who can measure life?

RUDOLPH H. KLAUDER

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NOTA BENE

My deepest gratitude for, and appreciation of, your interest in high-school students. Participation in the activities of the A.A.A.S. is a supreme joy and of the highest inspiration to a young person who is interested in science.

I attended the Richmond meeting of the Association in 1938 at the age of fifteen, upon the kind invitation of Dr. Herbert Zim, and became a member of the Association and a subscriber to THE SCIENTIFIC MONTHLY a few weeks later. I can assure you it was a great thrill and stimulus.

HERBERT SCHWARZ, JR.

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TO A *COPRINUS*

ON ACCIDENTALLY KICKING ONE OVER
(With Apologies to Robert Burns)

Wee modest flower of the dung
Whose virtues yet remain unsung—
Like all things living, old or young,
Or low or high,
Thou art from Nature's bosom sprung
To live and die.

In every alley, road, or lane
Where equine excrement has lain
Thou rearest up thy shaggy mane—
A noble sight
To charm the scientific brain
With rare delight.

Let none condemn thy low degree
Or habits of coprophily;
For were it not for such as thee
The myriad dead
Would fill the earth from sea to sea
Still undecayed.

If Psalliota's *lustrous fame*
Or Amanita's *evil name*
Are equally beyond thy claim—
The fates have set
Apart for thee a higher aim
And nobler yet.

For thou hast yielded mysteries
To scientists from learned Fries
To Buller, Kniep, and Vandendries,
Whose brains and wills
Sought laws of sex and spore release
Behind thy gills.

Thou hast made dry and scarious
Professors joy-delirious
Who found that sexes various
Existed in
Coprinus fimetarius
Instead of twin.

O fungus of the shaggy tress,
Of gills that slowly deliquesce—
When Man has sought eternal cess
Thou wilt remain
To liquidate the dreary mess
Left in his train.

THORVALDUR JOHNSON

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Canada

Technological Notes

Almost Automatic. Only those who have read proof know how maddening it is to try to find all the typographical errors, how certain some are to show up in the finished work. The new calculating machines prevent slips of that kind in presenting the results; the coded answers are printed by machine and then put directly into tables by photo-offset processes. About the ultimate seems to be the compilation of star data as reported by Dr. W. J. Eckert, who, besides being director of the Thomas J. Watson Laboratory of Columbia, is an astronomer of note. Photographs and punched cards covering each star go into the machine, and thousands of pages of tables, free from error, finally emerge.

Long View, Short View. Sometimes we wonder how much effort is wasted in attempts to hang onto every possibility, no matter how inefficient it may be, if over-all planning is successful. For example, there's $150,000 just spent on research to improve guayule and other plants to give us at least *some* natural rubber "in event of another emergency." Surely, our planners will be able to keep the future from getting down to that level. What we need, in a balanced peacetime program according to 1947 estimates of use, is about a million tons of rubber, slightly over half of it natural. We can never attain that supply without importing from countries that need to sell to us.

Plastics Everywhere. A release about plastic bottle caps and seals seems natural enough; the material is plumped up in water before being put in place, and it shrinks to a tight fit. Plastics in oil well drilling seem a little less plausible, but the explanation is simple: a thermosetting coat inside the well casing protects the metal against corrosion as the pipe goes through "hot spots" of corrosive salt water.

Safe Speed. Strictly for laboratory purposes, an airfoil device on a test automobile compensates for centrifugal force and enables tires to be tested at 90 miles an hour on a circular track. Any proposals to add such auxiliaries to ordinary cars had better be resisted. A report on Pennsylvania Turnpike accidents shows that many drivers are unable to handle vehicles at speeds now possible. The report concludes pessimistically that the human element is still the weakest factor in the safe-driving combination.

Average Irishman. An article in the *Population Bulletin* suggests Eire as an example to other nations, if war is to be avoided. That part of the Emerald Isle, scene of the Potato Famine a hundred years ago when the population was 6.5 million, is now a country of 3 million, the richest per capita in Europe. Emigration and late marriages are cited as reasons; Eire is now "mature," but not senile. The suggestion is attractive, but probably fraught with difficulties, especially in view of the recent announcement that the "average American" is an Irishman.

Quinine Back Home. United Fruit Company, famous for its banana boats, is paying attention to another indigenous crop of Central and South America: cinchona bark. The original trees, like the rubber tree, were exploited in their native habitat and only came into flourishing cultivation in the Orient. Now, plantations and research in the Americas show promise with plants of high alkaloid content.—M. W.

The Brownstone Tower

FEW professional scientists dependent on their own earnings are able to attain the ideal life of unrestricted, full-time research. Too often that paradise, glimpsed by a graduate student or research fellow, recedes as he grows older, and the work that he wanted to do is never done. A scientist is rarely paid for doing as he pleases, and perfect freedom for the satisfaction of scientific curiosity is available only in spare time. A scientist employed in full-time research is properly expected to work toward the solution of practical problems assigned to him or proposed by him. To the extent that he is permitted to pursue his work without distractions he will derive satisfaction from it second only to that arising from unrestricted research. He can be diverted from his primary work in many ways: he can be required to write an excessive number of reports, attend committee meetings, criticize manuscripts, answer inquiries, take inventories, prepare and defend budgets, and do many other things that are incidental to productive research. In short, if he is successful in research, clerical or administrative work will creep up on him like quicksand unless he is vigilantly noncooperative.

Such is the prospect to be faced by a young man who chooses to be a government scientist. If he is productive, he is most likely to reach the highest professional grades by giving up personal research for administration. There is no doubt that administrators of research should be men who have demonstrated their own capacity for research. On the other hand, all the cream of research talent should not be skimmed off into administration as fast as it appears. The whole purpose of a research organization is to produce new and useful information, and the best results can be obtained by encouraging men of demonstrated talent to remain in personal research, aided by a suitable number of assistants. This can best be done by offering to producers salaries at least equal to those of administrators, and this is the surest way to break down the prevalent notion that an administrator is superior to, and more valuable than, a producer. In my opinion creative talent is less common and consequently more valuable than administrative competence. The administrator should be the protector of producers, defending their research, getting the equipment and facilities they need, guarding them against annoying interruptions, reducing to a minimum every task that interferes with their research, and facilitating the publication of their results.

The article by Arthur S. Flemming, "Scientists and the Civil Service," in the June issue of the SM shows that the Civil Service Commission is moving in the right direction to obtain better scientists for government service and to make the conditions of their employment more attractive. But Commissioner Flemming, while proposing higher salaries and other benefits, failed to suggest that the highest salaries should be as readily attainable for research as for administration. This is now possible under the law, but in practice equality of remuneration is the exception rather than the rule. I think that no other reform could do so much to make government employment attractive to the ablest scientists.

F. L. CAMPBELL